#32

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4 April 2002
Commissioner of Patents and
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Washington DC 20231

PLEASE NOTE the above new address of Peter A Miller previously 71229 Leonberg, Germany for all future correspondence from USPTO.

PETITION TO THE COMMISSIONER

Appl.No: 09/242072
Filing date: 14.1.2000
IPC Appl. PCT/AU96/00442
Examiner : Cintins

Pursuant to 37 CFR §1.181, the Applicant petitions the Commissioner to withdraw the holding of abandonment of Application No.: 09/242072 "APPARATUS FOR LIQUID PURIFICATION" and treat the Applicant's response App.6 filed 16 August 2002 as timely and as a basis for determining a Declaration of Allowance.

GROUND

- The Applicant regards the manner in which the examination was and is being prosecuted to be seriously flawed; especially to the extent that a large number of flawed unjustifiable objections concerning the alleged introduction by the Applicant of "new matter" and "numerous vague and indefinite expressions" to the claims resulted in the wholly unnecessary prolongation of the examination period and a wholly unjustifiable notice of abandonment.
  The applicant is convinced that the application from App.3 (App = an Applicant reply to an Office Action) onwards (see. Annexes 1-3 and pages 2-4 of the following exposition) was at all times in a condition of Allowance and therefore there can be no grounds for declaring a condition of Abandonment at any time during the examination period from March, 2001 to the present.

13 January 2003, I Cintins, Examiner, Art Unit 1724

Notice of Abandonment, PTO Form – 1432
Grounds for Abandonment:
"Applicant's failure to timely file a proper reply to the Office letter mailed on 13 March 2002 A proposed reply was received on 16 August 2002, but it does not constitute a proper reply under 37 CFR 1.113(a) to the final rejection."

Background (OA=Office Action / App.=Applicant's Action):

1999

(App.1) 1999 January 29: IPC application transmittal letter with Declaration mailed to USPTO - "Apparatus for liquid purification".

2000

(OA1) 2000 January 14: USPTO filing date.

(OA2) 2000 Sept. 20 Application forwarded to National Stage Processing Branch of PTO by PCT Legal Office

(App.2) 2000 October 9: Applicant mailed amended IPC claims (marked up and clean) to comply with USPTO regulations.

(OA3) 2000 October 25: PTO mailed Filing Receipt (Acknowledgement of receipt of nonprovisional Patent Application (09/242.072).

2001

(OA4) 2001 March 3: ***PTO mailed Office examination action*** / **1st Final Rejection**

(App.3) 2001 April 2: Applicant mailed response to **1st Final Rejection**

(OA5) 2001 Sept. 3: Statutory 6 months from date of mailing of Final Rejection allowed to lapse by the PTO Examiner.

(OA6) 2001 October 2: Notice of Non-Compliant Amendment (37 CFR 1.121) mailed by Legal Instruments Examiner (Marked-up Amendments of Description and Claims I in Applicants response 2001,April 2 not supplied in "clean" version as well)

(App.4) 2001 October 20: "Clean" versions timely mailed to PTO.

2002

(OA7) 2002 March 10 ***PTO mailed Office examination action / 2nd Final Rejection***

(App.5) 2002 May 31 Applicant mailed response to **2nd Final Rejection**, APPLICATION NOW IN A CONDITION OF ALLOWANCE

(OA8) 2002, June 23 Office Action

(App.6) 2002 August 6 Applicant's response to Office Action 2002, June 23

(OA9) 2002 August 23 PTO communication

(App.7) 2002 Sept. 5 Petition by Applicant to Commissioner

(OA10) 2002 Dec. 12 Office action

2003

(OA11) 2003 January 6 PTO communication (Technology Center 1700) PETITION DISMISSED / NOTICE OF ABANDONMENT

(OA12) 2003 January 13 Office communication / NOTICE OF ABANDONMENT

(App.8) 2003 March 11 Applicant's response to OA10 (12 December 2002)

(App.9) 2003 March 26 Applicant's PETITION to the Commissioner

1. OA4 / App.3

1st and Final Rejection (OA4, 3 March 2001)

and

Applicant's response (App.3, 2 April 2001).

OA4: "A SHORTENED STATUTORY PERIOD OF 3 MONTHS TO REPLY".

Flaws in the Office Action OA4:

Flaw 1:

- The office action is non-conform with 37 CFR §1.113 (a):
  only the second or subsequent examination can be made final.

Flaw 2:

"Claims 1-4, 9-13, 15, 16 and 18-20 are rejected as failing to define the invention in the manner required by 35 USC 112, 2nd paragraph. The claims are narrative in form and contain numerous vague and indefinite expressions. For example, the terms: "such as", "preferably", etc.....are vague, and indefinite as to the limitations intended."

- Examiner's objection concerning matters of form is flawed because he fails to explain **why** the criticized terms would render the claims indefinite.

In DECISION ON APPEAL Ex parte Peter A. Miller; Appeal No. 2001-0779, Application No. 08/503,401 the Patent Judges made the following statements concerning similar objections by the same examiner:

"The initial burden of establishing a prima facie case of unpatentability, whether based on prior art or any other ground, rests on the examiner. Further, the test for definiteness under the 2nd paragraph, 35 USC §112 ***is whether one skilled in the relevant art would understand the bounds of the claim when it is read in light of the specification*** *..... That is, a claim complies with the second paragraph of section 112 if, when read in the light of the specification it reasonably apprises those skilled in the relevant art of the scope of the invention.*

....". ***the examiner (I. Cintins) fails to explain why the criticized terms would render the claims indefinite such that one skilled in the relevant art would not be apprised of the scope of the invention. Instead the examiner merely concludes, without any analysis, that the criticized terms "are vague and***

indefinite .....In summary, we reverse the examiner's rejection under the 2nd paragrah of 35 USC §112 of appealed claims 1 through 11 and 13 as indefinite".

The ground for this decision of the patent judges applies equally to the rejections under 2nd paragraph of 35 USC §12 of the present claims 1-4, 9-13, 15, 16 and 18-20 in 1st Final Rejection (OA4).

App.3: to avoid the necessity of a further Appeal to the Board of Appeals as was the case with the previous application of the Applicant those expressions rejected by the examiner and further potentially suspect expressions were comprehensively deleted from claims and description (amendments)

Flaw 3:

- Examiner's rejection in OA4 concerning the MERIT of the specification :

"Claims 10-12, 15, 16 and 18-20 are rejected under 35 USC 102(b) as being anticipated either of Hirs patents 2867325 or 2867326."

"Claims 1-4, 9 and 13 are rejected under 35 USC 103(a) as being unpatentable over Whitney, No. 2673176 in view of Hirs patent"

All objections on *merit* of the claims refuted by the Applicant.

Applicant maintains that regarding MERIT the pending claims are in a condition of allowance.

However in **all** subsequent Office Actions the examiner fails to enter the following crucial statement in accordance with *Ex parte Quayle, 1935 CD 11; 453 O.G. 213*:

"This application is in condition of allowance except for formal matters, prosecution as to the merits is closed."

The continued practice of the examiner in office actions OA4 to OA10 to conjure up objections and rejections based on formal matters alone can be seen as a major flaw in this examination.

2. AO6 / App.4

AO6: Letter from Legal Instruments Examiner (2 October 2001):

"Notice of non-compliance of Applicant's amendments (App.3):

37 CFR 1.121 requires "clean" versions of amended specification."

App.4: "Clean" versions of marked-up specification and claims forwarded by Applicant to PTO on 20 October 2002.

3. OA7 / App.5

OA7: 2nd and Final Rejection (OA7, 10 March 2002)

and

App.5: Applicant's response (31 May 2002).

A FURTHER SHORTENED STATUTORY PERIOD OF 3 MONTHS TO REPLY.

Flaw 4:

- The examiner fails to state that concerning MERIT the claims are in a condition of Allowance.

Flaw 5:

- Examiner ignores rules governing Final Rejection and the statutory period to reply set by himself and obviously applying to the examiner as well as the applicant. He allowed the maximum statutory period of 1st Final Rejection, OA4 **to lapse** with to date no office reply to Applicant's App.3 yet received by the applicant.

Flaw 6:

- Added to this the examiner on page 2, 1st paragraph of OA7 then tries to avoid the *lapsed state* of the application by basing his 2nd Final Rejection on what he refers to as an "amended" version of the specification by the Applicant filed 20 November 2001. This "amended" version was actually the "clean" version of the marked-up amended version of the application mailed by the Applicant in App.3 (2 April 2001) and now in a "lapsed" state.

Flaw 7:

- In the Applicant's opinion a "lapsed" state of an application caused by an examiner requires a "restart" of the Examination. If this is the case and it is allowable under the Examination Rules, then OA7 (3 March 2002) should also have started with a non-final office action in accordance with **37 CFR §1.113 (a):**

  "On the **second** or any subsequent examination or consideration by the examiner the rejection or other action may be made final."

Flaw 8:

- Page 2 of OA7: "The amendment filed 20 November 2001 is objected to under 35 USC 132 because it introduces new matter into the disclosure."
  As in ***1st the Final Rejection*** (OA4), the examiner fails to explain **why** the cited amendments to the description fall into the category "new matter" prescribed by 35 USC 132. Making amendments to the description to improve the clarity of the description of the invention (in compliance with the examiner's penchant for discovering "vague and indefinite expressions and new material") the subject matter of which does not touch the subject matter of the claims and introduces no further matter of a novel and inventive kind surely cannot fall into the category "new matter" prescribed by 35 USC 132.
  Before Board of Appeals the examiner's rejection in this case would be reversed.
  To avoid the necessity of appealing to the Board of Appeals the Applicant deleted most of the terms objected to as they were not essential to the specification regarding content or clarity (see page 1, App.5).

Flaw 9:

- Page 3 of OA7: "Claims 8, 9, 14 and 17 are objected to under 37CFR1.75(c) as being in improper form because a multiple dependent claim must refer to other claims in the alternative only (claim 17) and may not serve as a basis for any other multiple dependent claim (claims 8, 9 and 14)."
  The flaw:
  In App.5 on page 1, 2nd paragraph all objections proved to be unfounded and were refuted by the Applicant in his response.

Flaw 10:

- Page 3 of OA7: "Claims 1-7 are rejected under 35 USC 112, 1st paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. The limitation that a "pressure pump" is located in the system (claim 1, 5 and 7, line 18) does not appear to be supported by the disclosure originally filed,..."

The examiner's rejection is flawed in that the limitation that a "pressure pump" is located in the system **is** supported by the disclosure originally filed (see page pages 1 final paragraph and 2 of **App.5) and** belongs to prior art (GB PS 2280857 and the Hirs references in this office action (OA4) US PS 2867325 and 2867326 and therefore *per se* cannot constitute "new material" as prescribed in 35 USC 112

Flaw 11:

"and hence constitutes new matter, since this original disclosure only taught suction/vacuum pump 28 in the system."

The examiner failed to understand that the disclosed "suction/vacuum" pump is technically unsuited for the function described and added to this the function of this pump does not touch upon the innovative and inventive aspects of the disclosure. It is essentially a side-issue

In this respect the rejections and objections of the examiner must be vacated.

Flaw 12:

- Page 4 of OA7:

"Claims 1-7, 12, 15 and 16 are rejected as failing to define the invention in the manner required by 35 USC 112, second paragraph. The claims contain numerous vague and indefinite expressions. For example,....."

Once again, as already expounded by the Judges of the Board of Appeal (1. above) the examiner (I.Cintins) fails to explain **why** the criticized terms would render the claims indefinite such that one skilled in the relevant art would not be apprised of the scope of the invention. Instead the examiner merely concludes, without any analysis, that the criticized terms "are vague and indefinite.

As in the previous case, in a decision of the Board of Appeals the examiner's rejection under 2nd paragraph of 25 USC §112 of claims 1-7, 12, 15 and 16 as vague and indefinite would be reversed.

In fact all the objections of the examiner were entirely refuted for a whole variety of reasons and in spite of the fact that much of the terms objected to by the examiner were picked from terms expressly intended by the Applicant to avoid such treatment.

4. OA8 / App.6

OA8: Advisory Action (23 June 2002)

and

App.6: Applicant's response 6 August 2002

Flaw 13:

- OA8, page 3, lines 15-18:

"Applicant should note that the proposed amendment filed April 9, 2001 was not entered because it was considered "non-compliant" as explained in the office letter dated October 2, 2001."

If the amendment in App.3 (filed 9 April 2001) was "non-compliant" the Applicant should have been officially informed within the maximum Statutory Period for reply (3-6 months from mailing date of 1st Final Rejection 3 March 2001) as set by examiner.

Instead the examiner allowed the Statutory Period for reply to expire, thus, in the opinion of the Applicant, requiring the examiner to apply to the Commissioner to restart the Examination with a non-final 1st examination based on the specification version compliant with App.3 (filed 9 April 2002).

Flaw 14:

- Office Advisory Action (OA8) contained further objections concerning further matters of form with the shortened statutory period of 3 months from 2nd Final Rejection to reply.

OA8 was mailed 23 June 2002 after the expiry of the set shortened statutory period of 3 months.

37 CFR §1.135 clearly covers this situation:

"Abandonment for failure to reply within time period. (a) If an applicant fails to reply within the time period provided under §1.134 and §1.136, the application will become abandoned unless an Office action indicates otherwise."

MPEP 710.02

FINAL REJECTION - TIME TO REPLY

"**If an applicant initially replies within 2 months from the date of mailing** of any final rejection setting a 3-month shortened statutory period

for reply and the Office does not mail an advisory action until after the end of the 3-month shortened statutory period, the period for reply ....."

The Applicant failed to reply within 2 months from the date of mailing of the 2nd Final Rejection and was thereby severely disadvantaged by a limited scope to respond.

In the light of the limitations inherent in this and the flawed nature of the objections of the Office Advisory Action, OA8, the Applicant considers that the examiner deliberately attempted to manoeuver him into a condition of abandonment.

Flaw 15:

AO8, page 2 (in the specification)

"(1) Applicant's attempt to add to the disclosure that pressure cylinders 215 provide container sealing in addition to closure (see page 4, line 2 of marked-up copy) does not appear to be supported by the original disclosure and therefore raises the question of new matter."

The flaw (apart from the fact that the examiner is relying on appearances – "do not appear to be supported") lies in the fact that the matter **is** already disclosed in the original disclosure, page 2, line 30 and page 4 lines 16-20 (see page 1 (1) App.6).

Flaw 16:

AO8, page 2 (in the specification)

" (2) Applicant's attempt to change the disclosure that "A sample of filtrate flows through a turbidity meter 410" to "Simultaneously filtrate flows through a turbidity meter 410" (Page 5, line 18 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter."

The flaw (apart from the obvious observation that raising questions -"raises the question" - is not answering them) is that the examiner failed to consult Fig.4 of the application where clearly the filtrate flowing from the base of the filtrate chamber also simultaneously passes through the meter 410 (see page 1, (2) App.6). The further flaw is that the claims cannot be objected to or rejected as a result of an alleged change not contained in the claims and of an insignificant nature.

Flaw 17:

AO8, page 2 (in the specification)

" (3) Applicant's attempt to change the disclosure that "Cake drying" occurs in step 18 to "Gas continues to flow through the filter cake" (page 6, line 1 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter."

This is a technical nicety of no significance to the novelty and inventiveness of the claims and is not included in the text of any of the claims (see App.6, Page 1, last paragraph and page 2, 1st paragraph). Here again the Applicant was merely attempting to eliminate vague and indefinite terms as repeatedly demanded by the examiner and here again the examine fails to explain **why** this raises the question of new matter and here again the mere posing questions at this crucial stage of the examination cannot support the continued rejection of and objection to the claims of the application.

Flaw 18:

AO8 (1) page 2, (in the claims)

"Applicant's attempt to present currently pending claim 1, in its entirety, as amended Claim 3 is improper and confusing. If the applicant desires to merely eliminate the limitations of Claims 3, then Claim 3 should be cancelled and Claim 1 left unchanged."

The examiner is not objecting to or rejecting the currently pending Claim 1 but considers it "improper and confusing". Here again the examiner does not state **why** this is the case or explain the significance in patent law of "improper and confusing". After all, the alleged confusion of the examiner may have nothing to do with the merits of the application or patent law at all.

A further flaw is that pending Claim 1 had been pending since App.3 (mailed 2 April 2001) thus the suggested amendment by the examiner should have been made at the latest in OA7, 2nd Final Rejection (mailed 7 March 2002).

The reality is that the examiner chose to cause a major amendment to the Claims after expiry of the shortened statutory period to reply (3 months) knowing full well that it is unlikely that the ensuing juggling of and amendments to the numbering of

dependent and independent claims caused by such a major amendment would be sorted out before expiry of the mandatory maximum statutory period to reply of 6 months.

(NB: that this was the case is testified in OA10 (mailed 5 December 2002) where the final Advisory Action consisted entirely of just such objections - 3 months after expiry of the maximum period required by Statute.

In effect the examiner in "requesting this amendment" is introducing "new matter" which would normally require a re-start of the 2nd Final Rejection [see App.6, Page 2 (1)].

IN DEMANDING THIS AMENDMENT UNSUPPORTED BY PATENT LAW OR REQUIRED BY THE APPLICANT TO THE CLAIMS OF AN APPLICATION THAT WAS **ALREADY IN A CONDITION FOR ALLOWANCE** AT THIS STAGE OF THE EXAMINATION PROCEDURE THE EXAMINER, IF HE WERE ACTING IN A BONA FIDE MANNER, WOULD BE OBLIGED TO AT LEAST GRANT AN EXTENSION OF TIME FOR THE APPLICANT TO RESPOND WITHIN THE MAXIMUM TIME PERIOD STIPULATED BY STATUTE.

Flaw 19

AO8 (2) page 3 (in the claims)

"Similarly, Applicant's attempt to present currently pending claim 2 as amended claim 4 is improper and confusing".

Pending Claim 2 (as of office action 3 March, 2001):

"Liquid filtering apparatus according to Claim 1, thereby characterised, that means are provided to discharge the bed to a bed regeneration device (6), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse."

Amended Claim 4 (as of office action 3 March, 2001):

"A liquid purification system according to Claim 3, "once amended", whereby means are provided for **dosing** the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation."

Currently pending claim 2 was **never** presented as amended claim 4.

Claim 4 has been retained and is currently dependent on Claim 2.

"Furthermore, the bracketed portions of "twice amended" Claim 4 do not appear in currently pending Claim 4". Currently pending claim 4 recites "Liquid filtering apparatus according to Claim 2 or 3, whereby means are provided in the form of a conically perforated distributor 27 that extends over the entire internal cross-section of the turbid liquid chamber 5."

The examiner would appear to be confusing the issue here.

His designation "currently pending Claim 4" refers to the "clean version" where the numbering is consecutive (for clarity) and differs from the "marked-up" version.

5. OA9 / App.7

OA9: Office communication (received by applicant 2 September 2002):

- Applicant was warned that the application would become abandoned if an extension of time was not obtained.

App.7: (Applicant petitions Commissioner for relief / mailed 5 September 2002)

6. OA10 / App.8

OA10: Office Advisory Action (12 December 2002)

and

App.8: Applicant's response (11 March 2003)

Flaw 20

OA10: "The proposed amendment filed August 16, 2002 cannot be entered because the "marked-up" version of the claims does not correspond to the "clean" version of the claims....."

Once again the stance taken by examiner to underpin the continued

"Claims objected to: 8, 9, 14 and 17

and

Claims rejected: 1-7, 12, 15 and 16"

cannot be taken seriously and confirms the Applicant's opinion that he intended to use the confusion caused by the numbering of amendments caused by his belated requirement in **OA8** for a major amendment to the claims.

The examiner appears to have deliberately confused the issue by maintaining that the numbering of the "clean" version does not correspond with the "marked-up" amended version.

As explained in App.8, page 2 the applicant was notified by the Legal Instruments Manager in OA6 (2 October 2001) to provide "clean" version of the "marked-up" amended claims in the Applicant response (App.3) to the 1st Final Rejection (3 March 2001).

In this and following "clean" versions the claims were numbered consecutively, whereby all cancelled claims with their numbering were deleted.

This was accepted by the Office.

The examiner treated this "clean" version as the pending version in OA7 (2nd Final Rejection, 10 March 2002) and he made no objections on record concerning this "clean" version format until the end stages of the examination OA8 and OA10.

CONCLUSION

* At all major stages of the examination all "clean" versions of the application were in a condition of allowance:

1. **Stage OA4 / App.3 (April, 2001) .....ANNEX 1**
2. **Stage OA7 / App.5 (31 May, 2001).....A NNEX 2**

and

3. **Stage OA8 / App.6 (August, 2001).....ANNEX 3**

Verification is given above, pages 3-13, based on the enclosed matter:

OA4/App.3

OA6/App.4

OA7/App.5

OA8/App.6

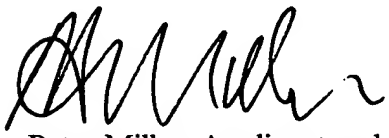
OA9/App.7

OA10/App.8

OA12

*** As the application from OA4/App.3 onwards was at all times in a condition of Allowance there <u>can be no grounds</u> for declaring a condition of Abandonment.**

*** Pursuant to 37 CFR §1.181, the Applicant petitions the Commissioner to withdraw the holding of abandonment of Application No.: 09/242072 "APPARATUS FOR LIQUID PURIFICATION" and treat the Applicant's response App.6 filed 16 August 2002 and the pending Application (ANNEX 3) as timely and as a basis for determining a Declaration of Allowance.**



Peter Miller, Applicant and Inventor

NB: The Applicant hereby grants power of attorney for access to his deposit account Acc. No. 501200 to the USPTO to cover fees (small entity) that may be due for this petition.

Annex 1

Clean version 1, stage OA4/App.3 (April, 2001)

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.
The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.
For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification involves an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon in powder form. The solid residues can not be regenerated and their disposal poses an acute environmental problem.
On the other hand, using apparatus of the nutsche-type filter with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out the large variety of suspended solids contained in industrial liquid effluent.

- produce excessive amounts of contaminated back-wash liquid.

- the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused thus precluding the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing relatively small concentrations of specific organic and inorganic contaminants in solution and in a colloidal state in the field of effluent and water purification.
- Prior art sand filtration inherently lacks the flexibility and versatility to handle today's demanding liquid purification requirements in the liquid processing industries.

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation.

Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes. It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in the medium to small size industrial sectors. This will be achieved by ulitizing specific through-puts 10-100 times those normally employed by prior art filters. Specific through-puts of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment. As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for total media regeneration to avoid altogether the necessity for waste dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

The schematic flow-sheet of the apparatus of the invention Fig.1 shows the purifying filter plant **1**, comprising essentially a lower stationary filtrate chamber **2** with a porous upper surface on which a section of an intermittently movable filter belt **4** is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions **3** of an upper contaminant container **5** fitted with a conically perforated feed distributor **27** extending over the entire upper horizontal section, a bed regeneration apparatus **6**, a bed material storage/dosing device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.
Filter aid suspended in liquid in tank **11** is dosed into the vented container **5**. While the pressure difference between the container **5** and the lower filtrate chamber **2** is raised, liquid to be purified in reservoir **10**, which may be dosed

with flocculating substances such as polyelectrolytes, is pumped using means **22** from reservoir **10** into container **5**. Simultaneously, suspensions of bed material recycled from regenerator **6** and activated powdered adsorbents are dosed using means **7/20** and **8/19** under pressure to a mixing section **29** of the delivery conduit **12** controlled by microprocessor **15** from input data from instrumentation **14** and **13** in the delivery conduit **12** and the filtrate conduit **16** respectively. The liquid quality and process parameters (concentration) controlled include turbidity, pH, hardness, chlorinated organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and through-put. Filtrate is recycled, if necessary, by means of a suction/pressure pump **28**, through conduits **16, 17** to reservoir **10** until the concentration of contaminants in the filtrate is reduced to a set level as measured at **13**. Filtrate flow is then switched to conduit **18** whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation **13**, pump **22** and all dosing apparatus are shut down and external gas is fed through conduit **23** to container **5** whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions **3** of the container **5** are raised and the bed is transported by the filter belt **4** and discharged into the bed regenerator **6**. The dependent rim portions **3** are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator **6**, in effect, removes adsorbate and entrapped particulate matter by means of ultra-sonic devices, turbulence producing devices, diffusion enhancing processes, etc. from the internal and external surfaces of the granular material, regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to **6** through conduit **24** and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit **25** to filter **9** to recover a solid waste. Depending on its nature, the recovered fluid is recycled to **10** or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator **6**.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders **215**, normally hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container **5** in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media **209, 210** are provided for feeding sections onto the lower filtrate chamber **2**. Drive rollers **220, 221** located on the surface of the media rolls and actuated by a brake/clutch mechanism **225** driven by the filter belt **217** through idle rollers **207** feed lengths of filter band over a guide **223** into the rollers **207** onto the surface of the moving filter belt **217**. Belt sensor **218** shuts down the belt drive motor **216** and actuates the band slitting mechanism **208** after which the sections of filter medium and the supporting filter belt are finally positioned in the container **5** and the depending rim portions of the container are lowered to seal the periphery of said sections.

After filtration the used section of filter medium is transported out of the container **1** for disposal.
Cassettes **212**, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles **223** by means of actuated rubberized rollers **213** and fed on guides **224** to synchronously driven feeder belt or belts **214**, whereby after positioning on the porous upper surface of the filtrate chamber **2**, the dependent rim portions **3** of the container **5** are lowered to seal both the belt and the overlying section of filter medium. After the filtration operation the section of filter medium is transported out of the container **1** for disposal.
Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims **3** as peripheral, integral sides of the container **5** are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders **215/304** is exerted when sealing the container **5** against the horizontal pervious base **2**. The bodies of the cylinders **305** are fixed to an external load-bearing framework **306** with the external extremity of the lubricated shafts **307** connected to the lower ends of vertically sectioned cylindrical sleeves **301** extending to and fixed at the ends of transverse beams **308** which in turn actuate thrust shafts **303** acting directly through seals onto the top peripheral part of the container **5**. Annular sections of guiding plastic material **302** are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves **301**.
Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:
A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent data are entered into the programmed microprocessor **15** and the following sequence of operations proceeds fully automatically:
Start

Testing:

1. A section of 10 micron retention filter paper from **212** is automatically fed into the container.
2. The dependent rim portions of the container **5** are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller **404** establishes a pre-set pressure differential between the chamber sealing space 402and the filtrate chamber **403**.
4. With the container **1** vented, approx. 15 l/m^2 of the suspension are introduced to the top container **5** and distributed over the surface of the sealed section of filter paper.

5. Compressed gas is introduced to the top chamber through control valve **407**, whereby the gas pressure and flow controllers **405/6** control the filtration operation and provide the data input to the microprocessor for computing the filtration characteristics of the suspension by determining the instantaneous volumetric flow of gas in the top container **5**. Simultaneously, filtrate flows through a turbidity meter **410** to record the degree of clarity of the filtrate for input to the microprocessor.

.....

The computer chooses the filtration mode and type of medium.
Mode: pre-coat with medium speed diatomite with 1% body feed.
Medium: 20 micron polyester mono-filament section of belt.

.....

6. The dependent rim portions **3** are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container **1**.
8. Steps **3,4,5** are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative. The section of belt is subjected to a standard cleaning/regeneration procedure after which steps **3,4,5** are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container **5**.

Filtration Operation:

10. While the chamber **5** is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve **401**. The feed rate is controlled by a pressure differential controller **405**. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve **401** shuts.
12. Valve **407** opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller **406** signals a break-through of gas through the filter cake.

Cake Washing:

14. Valve **407** shuts.
15. Valve **408** opens. A pre-set quantity of wash liquid is fed to the container **5**.
16. Valve **408** shuts. Valve **407** opens. Gas forces wash liquid through the cake.
17. The flow controller **406** signals a break-through of gas through the filter cake.

Cake Drying:

18. Gas continues to flow through the filter cake.
19. Timer shuts valve **407**. Container is vented by opening **411**. Container opens.

Cake Discharge:

20. Belt transport.
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container **1**.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber **2**, whereby the prior art fixed pervious bed is replaced by manually removable pervious elements **502** to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members **504**. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate **505** with smooth polished upper surfaces on which the removable elements, consisting of expanded sheets or layers of woven mesh of metal or plastics which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits **506** are provided, coinciding with the intervals of the fluid driven cylinders **215**, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.
Fig. 7 shows a schematic drawing, wherein the filter web consists of a belt that is driven by a motor or actuator **702** to reverse the direction of transport of the belt to enable the discharge of the filter bed or filter cake at either end of the purifying apparatus **1**. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator **6** and a filter cake receiver at either end can be accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.
The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce considerably the present negative impact on the environment.

Claims

1. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means **(6, 21)** for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an intermediate storage vessel for a subsequent filtration or purification cycle.

2. A liquid purification system according to Claim 1, whereby means are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.

3. A liquid purification apparatus according to Claim 1 or 2, whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

4. Liquid filtering apparatus according to any one of Claims 1-3, whereby means are provided in the form of a conically perforated distributor (**27**) that extends over the entire internal cross-section of the turbid liquid chamber (**5**).

5. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then

introduced to the interior of the turbid liquid chamber (**5**) to coincide with the pervious horizontal base (**2**) and sealed at the periphery by the dependent rim portion(s) (**3**) of the said chamber.

6. Liquid purifying apparatus according to any one of Claims 2 or 3, whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

7. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a

source of compressed gas and the interior of the upper contaminant chamber.

8. Method of liquid purification control according to Claim 5 or 7, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

9. Method of liquid purification control according to Claim 8, whereby the optimal mode of purification such as direct filtration by textiles, membranes, non-woven material, precoat filtration, deep bed purification with or without active powdered material is determined before or during any liquid purification operation.

Abstract

The invention concerns a liquid purifying apparatus that bridges the gap between prior art sand filters as applied mainly in the field of water treatment and pressure filters such as leaf, candle and cartridge filters as well as filter presses for filtration and purification in the liquid processing industries. In contrast to prior art sand filters where static beds of granular material are regenerated by back-washing techniques, the granular beds of the present invention are transported out of the filter container by a moving filter belt into an external bed-regenerating device after which the regenerated and reactivated bed is reused by dosing to the filter chamber with the incoming fluid to be purified. It is proposed to simultaneously dose a variety of active powdered adsorbents, such as activated carbon, molecular sieves, etc., to the purifier influent to remove specific dissolved contaminants, whereby the surface charge and particle size of this material are designed to adhere to the surface of the particulate matter of the bed. The dosing of active adsorbents and the particulate matter of the bed is controlled by a programmed microprocessor receiving input process data from influent and effluent instrumentation. A further feature is the provision of apparatus for feeding prefabricated sections of filter media such as membranes, non-woven and woven materials into the filter container

for application in fully automatic operation throughout the whole spectrum of industrial and communal liquid purification processes.

Annex 2

Clean version 2, stage OA7/App.5 (31 May 2002)

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.

The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.

For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification involves an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon in powder form. The solid residues cannot be economically regenerated and their disposal poses an acute environmental problem.

On the other hand, using apparatus of the nutsche-type filter with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out the large variety of suspended solids contained in industrial liquid effluent.
- produce excessive amounts of contaminated back-wash liquid.

and

- the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused thus precluding the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing specific contaminants in the field of effluent and water purification.

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation.

Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes.

It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in medium to small size industrial sectors. This will be achieved by utilizing specific throughputs 10-100 times those normally employed by prior art filters. Specific throughputs of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment: As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for regeneration to avoid altogether the necessity for waste dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

The schematic flow-sheet of the apparatus of the invention Fig.1 shows the purifying filter plant 1, comprising essentially a lower stationary filtrate chamber 2 with a porous upper surface on which a section of an intermittently movable filter belt 4 is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions 3 of an upper contaminant container 5 fitted with a conically perforated feed distributor 27 extending over the entire upper horizontal section, a bed regeneration apparatus 6, a bed material storage/dosing device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.
Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions of bed material recycled from regenerator 6 and activated powdered adsorbents are dosed using means 7/20 and 8/19 under pressure to a mixing section 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 13 and 14 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process

parameters (concentration) controlled include turbidity, pH, hardness, chlorinated organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and throughput. Filtrate is recycled, if necessary, by means of a suction/pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter by means of ultra-sonic, turbulence and diffusion producing devices from the internal and external surfaces of the granular material, thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media 209, 210 are provided for feeding sections onto the lower filtrate chamber 2. Drive rollers 220, 221 located on the surface of the media rolls and actuated by a brake/clutch mechanism 225 driven by the filter belt 217 through idle rollers 207 feed lengths of filter band over a guide 223 into the rollers 207 onto the surface of the moving filter belt 217. Belt sensor 218 shuts down the belt drive motor 216 and actuates the band slitting mechanism 208 after which the sections of filter medium and the supporting filter belt are finally positioned in the container 5 and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used section of filter medium is transported out of the container 1 for disposal.

Cassettes 212, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles by means of actuated rubberized rollers 213 and fed on guides 224 to synchronously driven feeder belt or belts 214, whereby after positioning on the porous upper surface of the filtrate chamber 2, the dependent rim portions 3 of the container 5 are lowered to seal both the belt and the overlying

section of filter medium. After the filtration operation the section of filter medium is transported out of the container 1 for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims 3 as peripheral, integral sides of the container 5 are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders 215/304 is exerted when sealing the container 5 against the horizontal pervious base 2. The bodies of the cylinders 305 are fixed to an external load-bearing framework 306 with the external extremity of the lubricated shafts 307 connected to the lower ends of vertically sectioned cylindrical sleeves 301 extending to and fixed at the ends of transverse beams 308 which in turn actuate thrust shafts 303 acting directly through seals onto the top peripheral part of the container 5. Annular sections of guiding plastic material 302 are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves 301.

Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:

A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent data are entered into the programmed microprocessor 15 and the following sequence of operations proceeds fully automatically:

Start

Testing:

1. A section of 10 micron retention filter paper from 212 is automatically fed into the container.
2. The dependent rim portions of the container 5 are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller 404 establishes a pre-set pressure differential between the chamber sealing space 402 and the filtrate chamber 403.
4. With the container 1 vented, approx. 15 l/m^2 of the suspension are introduced to the top container 5 and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve 407, whereby the gas pressure and flow controllers 405/6 control the filtration operation and indirectly establish the filtration characteristics of the suspension by determining the volumetric flow of gas in the top container 5. Simultaneously, filtrate flows through a turbidity meter 410 to record the degree of clarity of the filtrate for input to the microprocessor.

.....

The computer chooses the filtration mode and type of medium:

Mode: pre-coat with medium speed diatomite with 1% body feed.

Medium: 20 micron polyester mono-filament section of belt.

.....

6. The dependent rim portions 3 are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container 1.
8. Steps 3,4,5 are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative.
   The section of belt is subjected to a standard cleaning/regeneration procedure after which steps 3,4,5 are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container 5.
   Filtration Operation:
10. While the chamber 5 is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve 401. The feed rate is controlled by a pressure differential controller 405. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve 401 shuts.
12. Valve 407 opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller 406 signals a break-through of gas through the filter cake.
    Cake Washing:
14. Valve 407 shuts.
15. Valve 408 opens. A pre-set quantity of wash liquid is fed to the container 5.
16. Valve 408 shuts. Valve 407 opens. Gas forces wash liquid through the cake.
17. The flow controller 406 signals a break-through of gas through the filter cake.
    Cake Drying:
18. Gas continues to flow through the filter cake.
19. Valve 407 shuts. Container is vented by opening 411. Container opens.
    Cake Discharge:
20. Belt transport
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container 1.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber 2, whereby the prior art fixed pervious bed is replaced by manually removable pervious elements 502 to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members 504. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate 505 with smooth polished upper surfaces on which the removable elements, consisting of expanded sheets or layers of woven mesh of metal or plastics which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits 506 are provided, coinciding with the intervals of the fluid driven cylinders 215, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.

Fig. 7 shows a schematic drawing, wherein the filter web consists of a belt that is driven by a motor or actuator 702 to reverse the direction of transport of the belt to

enable the discharge of the filter bed or filter cake at either end of the purifying apparatus 1. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator 6 and a filter cake receiver at either end can be accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.
The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce considerably the present negative impact on the environment.

CLAIMS

1. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means **(6, 21)** for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an intermediate storage vessel for a subsequent filtration or purification cycle.

2. A liquid purification system according to Claim 1, whereby means **(7/20)** are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.
3. A liquid purification apparatus according to Claim 1, whereby means **(7/20, 8/19)** are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

4. Liquid filtering apparatus according to, Claim 2 or 3 whereby means are provided in the form of a conically perforated distributor (**27**) that extends over the entire internal cross-section of the turbid liquid chamber (**5**).

5. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber (**5**) and sealed at the periphery by the dependent rim portion(s) (**3**) of the said chamber.

6. Liquid purifying apparatus according to Claim 2 or 3 whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

7. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

8. Method of liquid purification control according to Claim 5 or 7, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics

Abstract

The invention concerns a liquid purifying apparatus that bridges the gap between prior art sand filters as applied mainly in the field of water treatment and pressure filters such as leaf, candle and cartridge filters as well as filter presses for filtration and purification in the liquid processing industries. In contrast to prior art sand filters where static beds of granular material are regenerated by back-washing techniques, the granular beds of the present invention are transported out of the filter container by a moving filter belt into an external bed-regenerating device after which the regenerated and reactivated bed is reused by dosing to the filter chamber with the incoming fluid to be purified. It is proposed to simultaneously dose a variety of active powdered adsorbents, such as activated carbon, molecular sieves, etc., to the purifier influent to remove specific dissolved contaminants, whereby the surface charge and particle size of this material are designed to adhere to the surface of the particulate matter of the bed. The dosing of active adsorbents and the particulate matter of the bed is controlled by a programmed microprocessor receiving input process data from influent and effluent instrumentation. A further feature is the provision of apparatus for feeding prefabricated sections of filter media such as membranes, non-woven and woven materials into the filter container

for application in fully automatic operation throughout the whole spectrum of industrial and communal liquid purification processes.

Annex 3

Clean version 3, stage OA8/App.6 (6 August 2002)

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.
The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.
For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification involves an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon in powder form. The solid residues cannot be economically regenerated and their disposal poses an acute environmental problem.
On the other hand, using apparatus of the nutsche-type filter with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out the large variety of suspended solids contained in industrial liquid effluent.
- produce excessive amounts of contaminated back-wash liquid.

and

- the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused thus precluding the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing specific contaminants in the field of effluent and water purification.

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation.
Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes.

It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in medium to small size industrial sectors. This will be achieved by utilizing specific throughputs 10-100 times those normally employed by prior art filters. Specific throughputs of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment: As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for regeneration to avoid altogether the necessity for waste dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

The schematic flow-sheet of the apparatus of the invention Fig.1 shows the purifying filter plant 1, comprising essentially a lower stationary filtrate chamber 2 with a porous upper surface on which a section of an intermittently movable filter belt 4 is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions 3 of an upper contaminant container 5 fitted with a conically perforated feed distributor 27 extending over the entire upper horizontal section, a bed regeneration apparatus 6, a bed material storage/dosing device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.
Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions of bed material recycled from regenerator 6 and activated powdered adsorbents are dosed using means 7/20 and 8/19 under pressure to a mixing section 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 13 and 14 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process

parameters (concentration) controlled include turbidity, pH, hardness, chlorinated organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and throughput. Filtrate is recycled, if necessary, by means of a suction/pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter by means of ultra-sonic, turbulence and diffusion producing devices from the internal and external surfaces of the granular material, thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media 209, 210 are provided for feeding sections onto the lower filtrate chamber 2. Drive rollers 220, 221 located on the surface of the media rolls and actuated by a brake/clutch mechanism 225 driven by the filter belt 217 through idle rollers 207 feed lengths of filter band over a guide 223 into the rollers 207 onto the surface of the moving filter belt 217. Belt sensor 218 shuts down the belt drive motor 216 and actuates the band slitting mechanism 208 after which the sections of filter medium and the supporting filter belt are finally positioned in the container 5 and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used section of filter medium is transported out of the container 1 for disposal.

Cassettes 212, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles by means of actuated rubberized rollers 213 and fed on guides 224 to synchronously driven feeder belt or belts 214, whereby after positioning on the porous upper surface of the filtrate chamber 2, the dependent rim portions 3 of the container 5 are lowered to seal both the belt and the overlying

section of filter medium. After the filtration operation the section of filter medium is transported out of the container 1 for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims 3 as peripheral, integral sides of the container 5 are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders 215/304 is exerted when sealing the container 5 against the horizontal pervious base 2. The bodies of the cylinders 305 are fixed to an external load-bearing framework 306 with the external extremity of the lubricated shafts 307 connected to the lower ends of vertically sectioned cylindrical sleeves 301 extending to and fixed at the ends of transverse beams 308 which in turn actuate thrust shafts 303 acting directly through seals onto the top peripheral part of the container 5. Annular sections of guiding plastic material 302 are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves 301.

Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:

A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent data are entered into the programmed microprocessor 15 and the following sequence of operations proceeds fully automatically:

Start

Testing:

1. A section of 10 micron retention filter paper from 212 is automatically fed into the container.
2. The dependent rim portions of the container 5 are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller 404 establishes a pre-set pressure differential between the chamber sealing space 402 and the filtrate chamber 403.
4. With the container 1 vented, approx. 15 l/m^2 of the suspension are introduced to the top container 5 and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve 407, whereby the gas pressure and flow controllers 405/6 control the filtration operation and indirectly establish the filtration characteristics of the suspension by determining the volumetric flow of gas in the top container 5. Simultaneously, filtrate flows through a turbidity meter 410 to record the degree of clarity of the filtrate for input to the microprocessor.

.....

The computer chooses the filtration mode and type of medium:

Mode: pre-coat with medium speed diatomite with 1% body feed.

Medium: 20 micron polyester mono-filament section of belt.

.....

6. The dependent rim portions 3 are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container 1.
8. Steps 3,4,5 are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative.
   The section of belt is subjected to a standard cleaning/regeneration procedure after which steps 3,4,5 are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container 5.
   Filtration Operation:
10. While the chamber 5 is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve 401. The feed rate is controlled by a pressure differential controller 405. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve 401 shuts.
12. Valve 407 opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller 406 signals a break-through of gas through the filter cake.
    Cake Washing:
14. Valve 407 shuts.
15. Valve 408 opens. A pre-set quantity of wash liquid is fed to the container 5.
16. Valve 408 shuts. Valve 407 opens. Gas forces wash liquid through the cake.
17. The flow controller 406 signals a break-through of gas through the filter cake.
    Cake Drying:
18. Gas continues to flow through the filter cake.
19. Valve 407 shuts. Container is vented by opening 411. Container opens.
    Cake Discharge:
20. Belt transport
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container 1.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber 2, whereby the prior art fixed pervious bed is replaced by manually removable pervious elements 502 to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members 504. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate 505 with smooth polished upper surfaces on which the removable elements, consisting of expanded sheets or layers of woven mesh of metal or plastics which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits 506 are provided, coinciding with the intervals of the fluid driven cylinders 215, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.

Fig. 7 shows a schematic drawing, wherein the filter web consists of a belt that is driven by a motor or actuator 702 to reverse the direction of transport of the belt to

enable the discharge of the filter bed or filter cake at either end of the purifying apparatus 1. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator 6 and a filter cake receiver at either end can be accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.
The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce considerably the present negative impact on the environment.

Claims

1. Liquid filtering apparatus in the form of an open or closed vessel containing deep, static beds of coarse granular material such as sand acting as filter medium supported on a porous floor that divides the vessel into an upper turbid liquid chamber with an inlet nozzle or connection and an upper outlet or connection for the removal of bed back-washing liquid and a lower filtrate chamber with a back-washing liquid inlet nozzle and a filtrate outlet nozzle, whereby an operation to remove suspended solids the turbid liquid is preferably passed from top to bottom through the bed after which, and before repeating the cycle, clean liquid such as filtrate is passed through the bed from bottom to top to remove the solids trapped in the bed which leave the container as a suspension through a top outlet nozzle or connection, whereby the container (1) with an upper turbid liquid feed conduit (12) and a lower filtrate outlet conduit (16) is divided in the vicinity of the pervious horizontal base (2) in such a way that a dependent rim portion(s) (3) of the upper turbid liquid chamber (5) is movable to facilitate the discharge of the bed from the container.

2. Liquid filtering apparatus according to Claim 1, whereby means are provided to discharge the bed to a bed regeneration device (6), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.

3. A liquid purification system according to Claim 2, whereby means are provided for dosing the cleaned and regenerated grains to the said turbid liquid chamber or to the feed of liquid to be purified during the purification operation.

4. A liquid purification apparatus according to Claim 3, whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

5. Liquid filtering apparatus according to Claim 3 or Claim 4, whereby means are provided in the form of a conically perforated distributor (27) that extends over the entire internal cross-section of the turbid liquid chamber (5).

6. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of

the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber (**5**) to coincide with the pervious horizontal base (**2**) and sealed at the periphery by the dependent rim portion(s) (**3**) of the said chamber.

7. Liquid purifying apparatus according to Claim 3 or Claim 4, whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

8. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum

pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

9. Method of liquid purification control according to Claim 6 or 8, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

Abstract

The invention concerns a liquid purifying apparatus that bridges the gap between prior art sand filters as applied mainly in the field of water treatment and pressure filters such as leaf, candle and cartridge filters as well as filter presses for filtration and purification in the liquid processing industries. In contrast to prior art sand filters where static beds of granular material are regenerated by back-washing techniques, the granular beds of the present invention are transported out of the filter container by a moving filter belt into an external bed-regenerating device after which the regenerated and reactivated bed is reused by dosing to the filter chamber with the incoming fluid to be purified. It is proposed to simultaneously dose a variety of active powdered adsorbents, such as activated carbon, molecular sieves, etc., to the purifier influent to remove specific dissolved contaminants, whereby the surface charge and particle size of this material are designed to adhere to the surface of the particulate matter of the bed. The dosing of active adsorbents and the particulate matter of the bed is controlled by a programmed microprocessor receiving input process data from influent and effluent instrumentation. A further feature is the provision of apparatus for feeding prefabricated sections of filter media such as membranes, non-woven and woven materials into the filter container

for application in fully automatic operation throughout the whole spectrum of industrial and communal liquid purification processes.

OA 4 / App. 3

Office Action Summary	Application No. 09/242,072	Applicant(s) Miller
	Examiner Ivars C. Cintins	Group Art Unit 1724

☐ Responsive to communication(s) filed on _____.

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-20* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-4, 9-13, 15, 16, and 18-20* is/are rejected.

☒ Claim(s) *5-8, 14, and 17* is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

Claims 5-8, 14 and 17 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim must refer to other claims in the alternative only. Accordingly, these claims have not been further treated on the merits.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-4, 9-13, 15, 16 and 18-20 are rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph. The claims are narrative in form and contain numerous vague and indefinite expressions. For example, the terms: "such as" (claim 1, lines 2 and 8; and claim 18, line 8), "preferably" (claim 1, line 7; and claim 19, line 4)), "thereby characterized" (claims 1-4, 9, 13, 15 and 16), "vicinity" (claim 1, line 13), "in such a way" (claim 1, line 13), "as well as" (claim 10, line 21), "are used as" (claim 12, lines 1-2), "appropriate" (claim 12, line 3), "first of all" (claim 13, lines 2-3), "Apparatus and method" (claims 15 and 16), "according to the defining preamble" (claim 15, line 1), "are employed" (claim 15, line 5), "known quality" (claim 15, line 7), "auch as" (claim 16, line 3), and "choose and implement the supply of the optimal

filter medium" (claim 16, lines 4-5) are vague, and indefinite as to the limitations intended.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 10-12, 15, 16 and 18-20 are rejected under 35 U.S.C. 102(b) as being anticipated by either Hirs patent (U.S. Patent No. 2,867,325 or 2,867,326). Each reference discloses a liquid filtering apparatus containing a web of filtering media in combination with control means for isolating portions of the filter web during use; and, particularly in view of the indefiniteness of the claims, this is all that appears to be required by claims 10-12, 15, 16 and 18-20.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

APP.3

Peter Miller
See Str.27
71229 Leonberg
Germany

2.4.2001

Commissioner of Patents and
Trademarks
Washington DC 20231

Re. US Appl.No: 09/242072
Int. Appl. No.; PCT/AU96/00442
Filing Date: 05 AUG 96
Office Action dated March 3, 2001

Office Action:

Claims 1-20	pending
Claims 1-4, 9-13, 15,16,18-20	rejected
Claims 5-8, 14, 17	objected to

- Claims 5-8, 14, 17 objected to under 37 CFR 1.75 (c) (multiple dependent claims).

All multiple claims have been eliminated in the amended claims.

- Claims 1-4, 9-13, 15, 16, 18-20 rejected under 35 USC 112 (narrative in form and contain numerous vague and indefinite expressions)

All suspect expressions have been eliminated from both the amended DESCRIPTION and CLAIMS.

- Claims 10-12, 15, 16, 18-20 rejected (anticipated by Hirs patent)
  - **Claims 10 and 11** have been cancelled in the amended claims.
  - The original and amended and now **independent claim 12** is in no way anticipated by Hirs patent. There is no evidence in this patent of the anticipation of the use of separate sheets of media for the purpose of process control or any other purpose.
  - The original as well as the amended and now **independent claim 15** is in no way anticipated by Hirs patent. There is absolutely no reference or even hint in his patent concerning means to measure the instantaneous rate of filtration by determining the volumetric flow of gas in the contaminant chamber during the filtration operation.

- Also in the amended now **independent claim 16** there is no anticipation in Hirs patent of the means for or even the concept of carrying out pre-testing of suspensions of unknown filtration characteristics by means of single sheets of medium of known filtration characteristics as well as carrying out permeability determinations during operation on sections of a permanent belt medium for purposes of control.
- **Claims 18-20** are cancelled.

- Claims 1-4, 9, 13 rejected under 35 USC 103 (a) (unpatentable over Whitney in view of either of Hirs patents).
  - **Claims 1-3.** Although an anticipation in Hirs patent of the independent **claim 1** seems unlikely in view of the preamble describing the prior art that belongs to an entirely foreign classification, namely, technology dealing with loose, granular filter medium. However, the applicant is anxious to avoid a controversy on this issue and it seems appropriate to base decisions on inventive merit etc. taking Hirs technology as the prior art.
    This being the case the preamble to the amended claims 1-3 now takes the form similar to that of the preamble of the original Claim 10. This prior art is totally devoid of the means for or concept of using the filter belt as support for and conveyor of beds of granular material to transport them to a bed regeneration device where the surfaces of the grains are cleaned and reactivated and then recycled to the contaminant filter chamber for subsequent filtration or purification cycles. The idea of fitting the Whitney filter with contaminant chambers of the present invention is too far-fetched to deserve any serious consideration. The examiner maintains that it would be obvious to anyone skilled in the art at the time the invention (1954/59) was made to provide the system of the primary reference with the sealing mechanism of either secondary reference in order to provide improved sealing for the treatment material of this primary reference system.
    Whether it can or not is irrelevant for judging the merits of the system of the present application.
    What needs clarification is the question as to whether the system of the primary reference in view of the secondary reference is capable of carrying out communal water purification with regenerative beds of sand.
    The answer is NO.

- The amended **Claim 4** now made dependent on the amended Claim 1 has in no way been anticipated the primary and secondary references.
- The amended **Claim 9** is central to the operation of the system of the present invention. One distributor of the primary reference consists of a spray head (44) and filter cloth (29) which are entirely unsuited for distributing a slurry of granular material such as sand. The same can be said for the further described "spreaders" (13) and (16) of the thick slurry feed.
  An important key to the present innovation described as as a "conically perforated distributor (27). The primary function is to evenly distribute a large throughput over a sealed section of filter belt and avoid any tendency to "hold-up" of the granular material on the distributor. This is achieved by eliminating all flat surfaces or extended horizontal lineal parts (e.g. perforated pipe) over the entire extent of the top of the distributor plate.
- **Claim 13** is cancelled.

- A brief description of the drawings is now given.
- Fig. 2 is amended to better show the dependent rim and eliminate numbers not appearing in the specification.

Enclosed: Amended Specification P. 1-12
Discette electronic copy (MS word)
Amended Drawing Fig. 2 (x2)

usually acts as a liability in affording the maximum protection for the invention disclosed. Applicant is advised to secure the services of a registered patent attorney or agent to prosecute the application, since the value of a patent is largely dependent upon skillful preparation and prosecution. The Office cannot aid in selecting an attorney or agent.

Applicant is advised of the availability of the publication "Attorneys and Agents Registered to Practice Before the U.S. Patent and Trademark Office." This publication is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to I. Cintins whose telephone number is (703) 308-3840. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

The fax phone numbers for this art unit are: (703) 305-3599 for "Official" faxes after Final Rejection; (703) 305-7718 for all other "Official" faxes; and (703) 305-3602 for "Draft" and other "Unofficial" faxes.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Ivars Cintins

Ivars C. Cintins
Primary Examiner
Art Unit 1724

I. Cintins
March 3, 2001

Notice of References Cited

Application No.	Applicant(s)
08/242,072	Miller
Examiner	**Group Art Unit** / **Page**
Ivars C. Cintins	1724 / Page 1 of 1

U.S. PATENT DOCUMENTS

		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	2,873,176	3/1954	Whitney	210	189
	B	2,867,325	1/1959	Hirs	210	387
	C	2,867,326	1/1959	Hirs	210	387
	D	4,908,369	3/1990	Bahr	210	401
	E	5,482,594	1/1996	Salminen	210	400
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						

NON-PATENT DOCUMENTS

		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	U		
	V		
	W		
	X		

APP. 3

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.
The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.
For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are **[mainly]** utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification **[normally]** involves [some form of] **an** "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is **[mostly]** a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon **[,etc., all normally]** in powder form. The solid residues can **[rarely]** not be **economically** regenerated and their disposal poses an acute environmental problem.
On the other hand, using apparatus of the nutsche-type filter **[in the form of] with** open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out **[most of]** the large variety of suspended solids contained in industrial liquid effluent.

[and]

- produce excessive amounts of contaminated back-wash liquid.

and

- **[Added to this,]** the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused **[and the necessity for utilizing relatively coarse granular material comprising the beds for removing organic and inorganic contaminants in solution] thus [precludes] precluding [on economic grounds]** the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing **relatively small concentrations** of specific **organic and inorganic** contaminants **in solution and in a colloidal state** in the field of effluent and water purification.
- **Prior art sand filtration inherently lacks the flexibility and versatility to handle today's demanding liquid purification requirements in the liquid processing industries.**

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds **for reuse** are regenerated **[and reused]** more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste **generation. [for disposal.]**

Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes.

It is **further** proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in the medium to small size industrial sectors. This will be achieved by ulitizing specific through-puts 10-100 times those normally employed by prior art filters. Specific through-puts of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. **Yet a [A]** further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment. **[The aim of the invention with] As for** industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for **[continuous] total media** regeneration to avoid **altogether** the necessity for **waste** dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.

Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.

Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.

Fig. 5 illustrates an innovative filtrate chamber design.

Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

[Fig. 1 is a] The schematic flow-sheet of the apparatus of the invention **Fig.1 [that consists of a] shows** the purifying filter plant **1**, comprising essentially a lower stationary filtrate chamber **2** with a porous upper surface on which a section of an intermittently movable filter belt **4** is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions **3** of an upper contaminant container **5** fitted with a

conically perforated feed distributor 27 extending over the entire upper horizontal section, a bed regeneration apparatus 6, a bed material storage/dosing [vessel] device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.

Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions of bed material recycled from regenerator 6 and activated powdered adsorbents are dosed using means 7/20 and 8/19 under pressure to a mixing section [27] 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 14 and 13 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process parameters (concentration) controlled include turbidity, pH, hardness, chlorinated [organics] organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and through-put. Filtrate is recycled, if necessary, by means of a suction/[vacuum] pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter [(] by means of ultra-sonic devices, turbulence producing devices, diffusion enhancing processes, etc.[)] from the internal and external surfaces of the granular material, [which may be an adsorbent itself,] thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally [taking the form of] hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media **209, 210** are provided for feeding sections onto the lower filtrate chamber **2**. Drive rollers **220, 221** located on the surface of the media rolls and actuated by a brake/clutch mechanism **225** driven by the filter belt **217** through idle rollers **207** feed lengths of filter band over a **[guides] guide 223** into the rollers **207** onto the surface of the moving filter belt **217**. Belt sensor **218** shuts down the belt drive motor **216** and actuates the band slitting mechanism **208** after which the **[section] sections** of filter medium and the supporting filter belt are finally positioned in the container **5** and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used **[sections] section** of filter medium **[are] is [normally]** transported out of the container **1** for disposal. Cassettes **212**, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles **223** by means of actuated rubberized rollers **213** and fed on guides **224** to synchronously driven feeder **belt or** belts **214**, whereby after positioning on the porous upper surface of the filtrate chamber **2**, the dependent rim portions **3** of the container **5** are lowered to seal both the belt and the overlying section of filter medium. After the filtration operation the **[material] section of filter medium** is transported out of the container **1** for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims **3 [when they take the form of] as** peripheral, integral sides of the container **5** are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in **the** cylinders 215/**304** is exerted when sealing the container **5** against the horizontal pervious base **2**. The bodies of the cylinders **305** are fixed to an external load-bearing framework **306** with the external extremity of the lubricated shafts **307** connected to the lower ends of vertically sectioned cylindrical sleeves **[302] 301** extending **to** and fixed at the **[top end to] ends of** transverse beams **308 [that] which** in turn actuate thrust shafts **303** acting directly through seals onto the top peripheral part of the container **5**. Annular sections of guiding plastic material **[301] 302 [preferably out of polytetrafluorethylene,]** are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves **[302] 301**.

Fig. 4 is a schematic representation of **part of the** apparatus of the invention for **controlling the**

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:

A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent **[information] data** are entered into the programmed microprocessor **15** and the following sequence of operations proceeds fully automatically:

Start

Testing:

1. A section of 10 micron retention filter paper from **212** is automatically fed into the container.
2. The dependent rim portions of the container **5** are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller **404** establishes a pre-set pressure differential between the chamber sealing space **402**and the filtrate chamber **403**.
4. With the container **1** vented, approx. 15 l/m^2 of the suspension are introduced to the top container **5** and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve **407**, whereby the gas pressure and flow controllers **405/6** control **the filtration operation** and **provide the data input to the microprocessor for computing [indirectly establish]** the filtration characteristics of the suspension by **[measuring] determining** the **instantaneous** volumetric flow of gas in the top container **5**. Simultaneously,**[A sample of]** filtrate flows through a turbidity meter **410** to record the degree of clarity of the filtrate for input to the microprocessor.

L .....

The computer chooses the filtration mode and type of medium.
Mode: pre-coat with medium speed diatomite with 1% body feed.
Medium: 20 micron polyester**[-monofil] mono-filament** section of belt.

.....

6. The **[depending] dependent** rim portions **3** are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container **1**.
8. Steps **3,4,5** are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative. The section of belt is subjected to a standard cleaning/regeneration procedure after which steps **3,4,5** are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container **5**. **Filtration Operation:**
10. While the chamber **5** is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve **401**. The feed rate is controlled by a pressure differential controller **405**. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve **401** shuts.
12. Valve **407** opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller **406** signals a break-through of gas through the filter cake. **Cake Washing:**
14. Valve **407** shuts.
15. Valve **408** opens. A pre-set quantity of wash liquid is fed to the container **5**.
16. Valve **408** shuts. Valve **407** opens. Gas forces wash liquid through the cake.

17. The flow controller 406 signals a break-through of gas through the filter cake. **Cake Drying:**
18. **[Cake drying.]** **Gas continues to flow through the filter cake.**
19. **Timer shuts valve** **[Valve]** **407** **[shuts.]** Container is vented by opening **411**. Container opens.
    Cake Discharge:
20. Belt transport. **[Cake discharge.]**
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container **1**.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber **2,** whereby the **prior art** fixed pervious bed **[of the prior art]** is replaced by manually removable pervious elements **502** to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members **504**. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate **505** with smooth polished upper surfaces on which the removable elements, **[preferably]** consisting of expanded sheets or layers of woven mesh of metal or plastics **[that]** **which** are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits **506** are provided, **[preferably]** coinciding with the **[intevals]** **intervals** of the fluid driven cylinders **215**, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning. **Fig. 7** shows a schematic drawing, wherein the filter web **[takes the form]** **consists** of a belt that is driven by a motor or actuator **702** to reverse the direction of transport of the belt to enable the discharge of the filter bed or filter cake at either end of the purifying apparatus **1**. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator **6** and a filter cake receiver at either end can be **[achieved.]** **accommodated.**

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.
The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce **[considerable]** **considerably** the present negative impact on the environment.

Claims

1. CANCELLED

[Liquid filtering apparatus in the form of an open or closed vessel containing deep, static beds of coarse granular material such as sand acting as filter medium supported on a porous floor that divides the vessel into an upper turbid liquid chamber with an inlet nozzle or connection and an upper outlet or connection for the removal of bed back-washing liquid and a lower filtrate chamber with a back-washing liquid inlet nozzle and a filtrate outlet nozzle, whereby ain operation to remove suspended solids the turbid liquid is preferably passed from top to bottom through the bed after which, and before repeating the cycle, clean liquid such as filtrate is passed through t-he bed from bottom to top to remove the solids trapped in the bed which leave the container as a suspension through a top outlet nozzle or connection, thereby characterized, that the container (19 with an upper a turbid liquid feed conduit 812) and a lower filtrate outlet conduit (16) is divided in the vicinity of the pervious horizontal base (2) in such a way that a dependent rim portion(s) (3) of the upper turbid liquid chamber (5) is movable to facilitate the discharge of the bed from the container.]

2. CANCELLED

[Liquid filtering apparatus according to Claim 1, thereby characterized, that means are provided to discharge the bed to a bed regeneration device (8), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.]

3. "once amended"

[Liquid filtering apparatus according to Claim 1, thereby characterized, that means are provided to discharge the bed to a bed regeneration device (6), where the material of the bed is cleaned or cleaned and reactivated and thence recycled to a dosing device (7/20) and thence to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.]

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim

portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means **(6, 21)** for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an intermediate storage vessel for a subsequent filtration or purification cycle

4. "once amended"

[Liquid filtering apparatus according to Claim 1, thereby characterized, that means are provided to discharge the bed to a bed regeneration device (6), where the material of the bed is cleaned or cleaned and reactivated and thence recycled to the dosing device (7/20) and thence dosed to the turbid liquid chamber (5) of the filtering apparatus (1) during the filtration operation, whereby the depth of the bed increases incrementally during the operation.]

A liquid purification system according to Claim 1, whereby means are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.

5. CANCELLED

[Liquid purifying apparatus and method according to Claims 1-4, thereby characterized, that the cleaned and reactivated bed before

being recycled to the turbid liquid chamber (5) for reuse is mixed with active powdered material such as bleaching earth, ion-exchange resins, activated carbon, etc.]

6. "once amended"

[Liquid purifying apparatus and method according to Claim 5, thereby characterized, that a dosing apparatus (8/19) is employed to dose the active powdered material to the granular material of the bed either before or during the purification operation when the depth of the bed increases incrementally.]

A liquid purification apparatus according to Claim 1, whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

7. CANCELLED

8. CANCELLED

9. "once amended"

Liquid filtering apparatus according to [Claim 1, thereby characterized, that] any one of Claims 1-6, whereby means are provided in the form of a conically perforated distributor (**27**) that extends over the entire internal cross-section of the turbid liquid chamber (**5**).

10. CANCELLED

11. CANCELLED

12. "once amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both

contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, [Liquid filtering apparatus according to Claim 10,] whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber (**5**) to coincide with the pervious horizontal base (**2**) and sealed at the periphery **[**(402)**]** by the dependent rim portion(s) (**3**) of the said chamber.

13. CANCELLED

14. "once amended"

Liquid purifying apparatus according to any one of Claims 4-6, [thereby characterized, that] whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

15. "once amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with

the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, [Apparatus and method of filtration control according to the defining preamble of claim 10, whereby means to control the filtration operation consist of a gas flow controller, a gas throttling valve and a gas pressure controller connected in series from a source of compressed gas to the turbid liquid chamber (5), thereby characterized, that the said means are employed to measure the permeability of any filter media before or during any liquid filtration or purification operation by introducing and filtering a volume of liquid of known quality to the turbid liquid chamber.] whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (406), gas throttling valve (407) and gas pressure meter (405) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

16. "once amended"

Method of liquid purification control according to Claim 12 or 15, [thereby characterized, that whereby the quality of the turbid liquid and filtrate is determined by instrumentation such as (13, 14), whereby optionally the data are fed to a microprocessor / process controller (15) to choose and implement the supply of the optional filter medium before or during any liquid purification operation.] whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (13, 14), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

17. "once amended"

Method of liquid purification control according to [Claims 11-16, thereby characterized, that] Claim 16, whereby the optimal mode of purification such as direct filtration by textiles, membranes, non-woven material, precoat filtration, deep bed purification with or

without active powdered material [, etc.] is determined before or during any liquid purification operation.

18. CANCELLED

19. CANCELLED

20. CANCELLED

OA 6 / App. 4

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.

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Notice of Non-Compliant Amendment (37 CFR 1.121)

The amendment filed on 4-9-01 is considered non-compliant because it has not been submitted in the format required under 37 CFR 1.121, as amended on September 8, 2000 (see *65 Fed. Reg. 54603*, Sept. 8, 2000, and *1238 O.G. 77*, Sept. 19, 2000).

☑ 1. The amendment does not include a clean version of the replacement paragraph(s)/section(s). 37 CFR 1.121(b)(1)(ii).

☐ 2. The amendment does not include a marked-up version of the replacement paragraph(s)/section(s). 37 CFR 1.121(b)(1)(iii)

☑ 3. The amendment does not include a clean version of the amended claim(s). 37 CFR 1.121(c)(1)(i)

☐ 4. The amendment does not include a marked-up version of the amended claim(s). 37 CFR 1.121(c)(1)(ii)

☐ 5. Other _____.

☐ **PRELIMINARY AMENDMENT:** Unless applicant re-submits the preliminary amendment in compliance with revised 37 CFR 1.121 within ONE MONTH of the mail date of this letter, examination on the merits may commence without entry of the originally proposed preliminary amendment. This notice is not an action under 35 U.S.C. 132, and this ONE MONTH time limit is not extendable.

☑ **AMENDMENT AFTER NON-FINAL ACTION:** Since the above mentioned reply appears to be *bona fide*, applicant is given a TIME PERIOD of ONE (1) MONTH or THIRTY (30) DAYS from the mailing date of this notice, whichever is longer, within which to supply the omission or correction in order to avoid abandonment. EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136(a).

For your convenience, attached to this correspondence is a copy of an informational flyer (MPEP Bookmark Bulletin on "Simplified Amendment Practice").

Teresa Wortman
Legal Instruments Examiner

App. 4

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14 October 2001

Commissioner of Patents and
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Washington DC 20231

Re. US Appl.No: 09/242072
Int. Appl. No.; PCT/AU96/00442
Filing Date: 14 January 2000
Office Action dated 2 October 01

Office Action:

- The amendment does not include a clean version of the replacement paragraph(s)/section(s) 37CFR 1.121(b)(1)(ii) (all sections were amended)
- The amendment does not include a clean version of the amended claim(s) 37CFR 1.121(b)(1)(ii) (all claims were amended)

Enclosed: Clean version of specification (description p. 1-6 and claims p. 7-10)

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.

The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.

For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification involves an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon in powder form. The solid residues can not be economically regenerated and their disposal poses an acute environmental problem.

On the other hand, using apparatus of the nutsche-type filter with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out the large variety of suspended solids contained in industrial and domestic liquid effluent,
- produce excessive amounts of contaminated back-wash liquid.

and the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused thus precluding the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing relatively small concentrations of specific organic and inorganic contaminants in solution and in a colloidal state in the field of effluent and water purification and

- inherently lacks the flexibility and versatility to handle todays demanding liquid purification requirements in the liquid processing industries.

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation. Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water

purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes. It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in medium to small size industrial sectors. This will be achieved by utilizing specific throughputs 10-100 times those normally employed by prior art filters. Specific throughputs of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment. As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for total media regeneration to avoid altogether the necessity for waste dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

The schematic flow-sheet of the apparatus of the invention **Fig.1** shows the purifying filter plant **1**, comprising essentially a lower stationary filtrate chamber **2** with a porous upper surface on which a section of an intermittently movable filter belt **4** is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions **3** of an upper contaminant container **5** fitted with a conically perforated feed distributor **27** extending over the entire upper horizontal section, a bed regeneration apparatus **6**, a bed material storage/dosing device **7/20**, a filter aid suspension tank **11**, one or more adsorbent storage/dosing devices **8/19**, a reservoir for liquid to be purified **10** and a residue filter **9**.
Filter aid suspended in liquid in tank **11** is dosed into the vented container **5**. While the pressure difference between the container **5** and the lower filtrate chamber **2** is raised, liquid to be purified in reservoir **10**, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means **22** from reservoir **10** into container **5**. Simultaneously, suspensions of bed material recycled from regenerator **6** and activated powdered adsorbents are

dosed using means 7/20 and 8/19 under pressure to a mixing section 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 14 and 13 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process parameters (concentration) controlled include turbidity, pH, hardness, chlorinated organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and throughput. Filtrate is recycled, if necessary, by means of a suction / pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18, whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter by means of ultra-sonic devices, turbulence producing devices, diffusion enhancing processes, etc. from the internal and external surfaces of the granular material, thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.
A plurality of rolls of filter media 209, 210 are provided for feeding sections onto the lower filtrate chamber 2. Drive rollers 220, 221 located on the surface of the media rolls and actuated by a brake/clutch mechanism 225 driven by the filter belt 217 through idle rollers 207 feed lengths of filter band over a guide 223 into the rollers 207 onto the surface of the moving filter belt 217. Belt sensor 218 shuts down the belt drive motor 216 and actuates the band slitting mechanism 208 after which the sections of filter medium and the supporting filter belt are finally positioned in the container 5 and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used section of filter medium is transported out of the container 1 for disposal.
Cassettes 226, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as

membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles **211, 212** by means of actuated rubberized rollers **213** and fed on guides **224** to synchronously driven feeder belt or belts **214**, whereby after positioning on the porous upper surface of the filtrate chamber **2**, the dependent rim portions **3** of the container **5** are lowered to seal both the belt and the overlying section of filter medium. After the filtration operation the section of filter medium is transported out of the container **1** for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims **3** as peripheral, integral sides of the container **5** are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders **215/304** is exerted when sealing the container **5** against the horizontal pervious base **2**. The bodies of the cylinders **305** are fixed to an external load-bearing framework **306** with the external extremity of the lubricated shafts **307** connected to the lower ends of vertically sectioned cylindrical sleeves **301** extending to and fixed at the ends of transverse beams **308** which in turn actuate thrust shafts **303** acting directly through seals onto the top peripheral part of the container **5**. Annular sections of guiding plastic material **302** are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves **301**.

Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:
A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent data are entered into the programmed microprocessor **15** and the following sequence of operations proceeds fully automatically:

Start

Testing:

1. A section of 10 micron retention filter paper from **212** is automatically fed into the container.
2. The dependent rim portions of the container **5** are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller **404** establishes a pre-set pressure differential between the chamber sealing space **402** and the filtrate chamber **403**.
4. With the container **1** vented, approx. 15 l/m^2 of the suspension are introduced to the top container **5** and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve **407**, whereby the gas pressure and flow controllers **405/6** control the filtration operation and provide the data input to the microprocessor for computing the filtration characteristics of the suspension by determining the instantaneous volumetric flow of gas in the top

container **5**. Simultaneously, filtrate flows through a turbidity meter **410** to record the degree of clarity of the filtrate for input to the microprocessor.

L .....

The computer chooses the filtration mode and type of medium.
Mode: pre-coat with medium speed diatomite with 1% body feed.
Medium: 20 micron polyester mono-filament section of belt.

.....

6. The dependent rim portions **3** are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container **1**.
8. Steps **3,4,5** are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative. The section of belt is subjected to a standard cleaning/regeneration procedure after which steps **3,4,5** are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container **5.**

Filtration Operation:

10. While the chamber **5** is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve **401**. The feed rate is controlled by a pressure differential controller **405**. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve **401** shuts.
12. Valve **407** opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller **406** signals a break-through of gas through the filter cake.

Cake Washing:

14. Valve **407** shuts.
15. Valve **408** opens. A pre-set quantity of wash liquid is fed to the container **5**.
16. Valve **408** shuts. Valve **407** opens. Gas forces wash liquid through the cake.
17. The flow controller **406** signals a break-through of gas through the filter cake.

Cake Drying:

18. Gas continues to flow through the filter cake.
19. Timer shuts valve **407** Container is vented by opening **411**. Container opens.

Cake Discharge:

20. Belt transport.
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container **1**.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber **2,** whereby the prior art fixed pervious bed is replaced by manually removable pervious elements **502** to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members **504**. According to the invention only

planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate **505** with smooth polished upper surfaces on which the removable elements, consisting of expanded sheets or layers of woven mesh of metal or plastics which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits **506** are provided, coinciding with the intervals of the fluid driven cylinders **215**, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.

Fig. 7 shows a schematic drawing, wherein the filter web consists of a belt that is driven by a motor or actuator **702** to reverse the direction of transport of the belt to enable the discharge of the filter bed or filter cake at either end of the purifying apparatus **1**. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator **6** and a filter cake receiver at either end can be accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.

The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce considerably the present negative impact on the environment.

Claims

1.

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means **(6, 21)** for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an

intermediate storage vessel for a subsequent filtration or purification cycle

2.
A liquid purification system according to Claim 1, whereby means are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.

3.
A liquid purification apparatus according to [any one of Claims 1-5,] Claim 1 or 2, 1whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

4.
Liquid filtering apparatus according to any one of Claims [1-6] 1-3, whereby means are provided in the form of a conically perforated distributor (27) that extends over the entire internal cross-section of the turbid liquid chamber (5).

5.
In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or

drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber **(5)** to coincide with the pervious horizontal base **(2)** and sealed at the periphery by the dependent rim portion(s) **(3)** of the said chamber.

6.
Liquid purifying apparatus according [to any one of Claims 4-6,] to Claim 2 or 3, whereby the dosing devices are controlled by a microprocessor **(15)** from input signals from feed and filtrate instrumentation **(13,14)**.

7.
In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of

said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

8.
Method of liquid purification control according to Claim [**12** or **15**,] 5 or 7, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

9.
Method of liquid purification control according to Claim [16] 8, whereby the optimal mode of purification including direct filtration by woven materials, membranes, non-woven material, precoat filtration, deep bed purification with or without active powdered material is determined before or during any liquid purification operation.

OA 7/App.5

MF-25

Office Action Summary	Application No. 09/242,072	Applicant(s) Miller
	Examiner Ivars Cintins	Art Unit 1724

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Nov 20, 2001.

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-9, 12, and 14-17 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-7, 12, 15, and 16 is/are rejected.

7) ☒ Claim(s) 8, 9, 14, and 17 is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☒ The proposed drawing correction filed on Apr 9, 2001 is: a) ☒ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☐ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

The amendment filed November 20, 2001 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

(1) that "relatively small concentrations of specific organic and inorganic contaminants in solution and in a colloidal state" are removed by adsorbents (page 1, lines 36-37, of the specification);

(2) that prior art sand filters "inherently lacks the flexibility and versatility to handle todays demanding liquid purification requirements in the liquid processing industries" (page 1, lines 39-41, of the specification)

(3) that the aim of the invention is for "total media regeneration" (page 2, line 22, of the specification);

(4) that filtrate is recycled by a pressure pump (page 3, line 8, of the specification);

(5) that "diffusion enhancing processes" are employed (page 3, line 21, of the specification);

(6) that the controllers "provide the data input to the microprocessor for computing the filtration characteristics of the suspension determining instantaneous volumetric flow of gas

in the top container" (page 4, last three lines, of the specification) and;

(7) that a timer shuts valve 407 during the drying operation (page 5, line 39, of the specification).

Applicant is required to cancel the new matter in the reply to this Office action.

The proposed drawing corrections filed on April 9, 2001 have been approved.

Claims 8, 9, 14 and 17 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim must refer to other claims in the alternative only (claim 17), and may not serve as a basis for any other multiple dependent claim (claims 8, 9 and 14). Accordingly, these claims have not been further treated on the merits.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one

skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. The limitation that a "pressure pump" is located in the system (claim 1, 5 and 7, line 18) does not appear to be supported by the disclosure originally filed, and hence constitutes **new matter**, since this original disclosure only taught suction/vacuum pump **28** in the system.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-7, 12, 15 and 16 are rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph. The claims contain numerous vague and indefinite expressions. For example, the term "the stationary, sealed position" (claims 1, 5 and 7, line 2) lacks antecedent basis in the claims, and is therefore indefinite. Also, the term "whereby means are provided" (claims 2-4, lines 1-2) is vague, and indefinite as to the limitation intended. The term "the pervious horizontal base" (claim 5, line 44) lacks antecedent basis in the claim, and is therefore indefinite. Claims 12, 15 and 16 depend from a canceled claim (i.e. claim 10), and are therefore

indefinite. Furthermore, the terms "are used as" (claim 12, lines 1-2), "appropriate" (claim 12, line 3), "Apparatus and method" (claims 15 and 16, line 1), "according to the defining preamble" (claim 15, line 1), "are employed" (claim 15, line 5), "known quality" (claim 15, line 7), "auch as" (claim 16, line 3), and "choose and implement the supply of the optimal filter medium" (claim 16, lines 4-5) are vague, and indefinite as to the limitations intended. Claim 6 depends from an indefinite claim (i.e. 2 or 3), and is therefore itself indefinite.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

APP 5 (31 May 2002)

Response to Office Action / Cintins / 10 March 02

"The amendment filed Nov. 20 01 is objected to under 35USC132 because it introduces new matter into the disclosure.

- Objection (1) now deleted from the text.
- Objection (2) now deleted.
- Objection (3) now deleted.
- Objection (4) does not concern new material. The original description of pump 28 as a suction/vacuum pump is an error. From the description of its function and the flow sheet Fig. 5 it is obvious that the described function can only be carried out by a pump producing a positive (above atmospheric pressure) outlet pressure. The term suction/pressure pump is normally used for pumps of this nature and applies in the case at hand.
- Objection (5) now deleted.
- Objection (6) now deleted ("determining" can be seen to be synonymous with "measuring").
- Objection (7) now deleted.

PS: see pages 4 & 5 of the petition.

"Claims 8, 9, 14 and 17 are objected to under 37CFR1.75© as being in improper form because a multiple dependent claim must refer to other claims in the alternative only (claim 17), and may not serve as a basis for any other multiple dependent claim (claims 8,9 and 14). **Accordingly, these claims have not been further treated on the merits.**"

In fact with the exception of Claim 17 these claims should have been further treated on the merits.

Reason:

In the response 2.April.01 to office action 3 March 01

- Dependent claim 8 was cancelled anyway.
- Dependent claim 9 refers in the alternative to any one of claims 1-6. Multiple dependent claim 5 , independent claim 1 and single dependent claim 2 were effectively cancelled with bracketing leaving independent claim 3 and single dependent claims 4 and 6 as sole effective references.
- Dependent claim 14 refers in the alternative to any one of claims 4-6 , effectively referring to single dependent claims 4 and 6 as sole effective references.
- In the present response claim 17 is cancelled.

Claims 1-7 are rejected under 35USC112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. The limitation that a "pressure pump" is located in the system (claim 1,5 and 7, line 18) does not appear to be supported by the disclosure originally filed, and hence constitutes new matter, since this original disclosure only taught suction/vacuum pump 28 in the system.

In the original IPC disclosure pages 2/3 under the heading THE INVENTION:

""Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the **pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10,.....is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions .....are dosed** using means 7/20 & 8/19 **under pressure** "

In the original IPC disclosure means 22 is obviously a **"pressure pump located in a conduit** (here 12) **in fluid connection with the means of contaminant supply** (here 10) **and the**

interior of the upper contaminant chamber delivering liquid to be purified to the container (here 5)".
Page 3, l 8-12:
"Filtrate is recycled, if necessary by means of a suction/vacuum pump (28) through conduits 16 & 117 to reservoir 10.....Filtrate flow is switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set **pressure differential** across the bed ....."
Although some suction/vacuum pumps can transport liquid issuing from the outlet the designation here of suction/vacuum pump is obviously an error and should read suction/pressure pump. The functioning of this pump is not of vital importance to the process..
The **pressure differential across the bed** is the function carried out by means 22 (a pressure pump).
PS: see page 5 of the petition.

„Claims 1-7, 12, 15 and 16 are rejected as failing to define the invention in the manner required by 35 USC 112, second paragraph.
The claims contain numerous vague and indefinite expressions.
For example

- The term "that functions intermittently and in the stationary, sealed position (Claims 1, 5 and 7, line 2) lacks antecedent basis in the claims, and is therefore indefinite.
  False from original application, p.2, under THE INVENTION: "Fig.1 is a schematic flow-sheet of the apparatus of the invention that consists of a purifying filter plant 1,.....a lower **stationary filtrate chamber**.....on which a section of an **intermittently movable** filter belt..... which in operation is **stationary** and **sealed at the periphery** by vertically movable dependent rim portions 3 of an upper contaminant container 5 "
  All the essential characteristics quoted are supported in the original IPC disclosure.
- The term "whereby means are provided" (claims 2-4, lines 1-2) is vague and indefinite as to the limitation intended.
  Wrong Claim 2 is cancelled and in Claim 3 the term is not present. .
  Claim 4 "once amended" and Claim 6 "once amended" appear to have been meant and the limitations **7/20** and **8/19** are now introduced in these claims as "second amendments".
  The term "the pervious horizontal base (2)" (claim 5, line 44) lacks antecedent basis in the claim and is therefore indefinite.
  False claim 5 is cancelled.
  Apparently claim 12 "once amended" is meant.
  (see original IPC disclosure above –first bullet THE INVENTION "Fig 1 is a .....lower stationary filtrate chamber 2 with a porous upper surface on which a section of an intermittently movable filter belt.....sealed at the periphery".).
  To avoid further discussion the phrase "to coincide .....horizontal base" is now cancelled.
- Claims 12, 15 and 16 depend from a cancelled claim (i.e. claim 10) and are therefore indefinite.
  False in "once amended" Claims 12 and 15 the dependency on Claim 10 was deleted and for claim 16 a dependency on Claim 10 never existed.

Furthermore the terms

- "are used as" (claim 12, lines 1-2)
  semantics **only** (serve as, act as, are designed to, meant to, etc, can all be used)
  appropriate" (claim 12, line 3)

semantics only (right, correct, exact, precise, required etc. are all appropriate).

- "apparatus and method"(claims 15 and 16, line 1)
  False 15 is a separate apparatus claim and 16 is a separate method claim.
- "according to the defining preamble" claim 15, line 1)...
  False (already deleted in the "once amended" claim 15).
- "are employed" (claim 15, line 5)
  False (already deleted in "once amended" claim 15)
- "known quality" (claim 15, line 7)
  False (already deleted in "once amended" claim 15)
- "such as" (claim 16, line 3)
  False (already deleted in "once amended" claim 16)
- choose and implement the supply of the optimal filter medium" (claim 16, lines 4-5) are vague, and indefinite as to the limitations intended.
  False (already deleted in "once amended" claim 16).
- Claim 6 depends from an indefinite claim (i.e. 2 or 3) and is therefore itself indefinite.
  Wrong (meant is claim 14 "once amended" dependent on Claim 4 and 6 each now "twice amended" and no longer indefinite.

Enclosed are

1) Copy of the complete amended claims at May, 02
2) Copy of the "clean" version at May, 02 of claims after "second amendments" for the purpose of clarity only.
3) Copy of the complete amended description at May, 02
4) Copy of the "clean" version at May, 02

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A belt filter

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CLAIMS

1. In a travelling web flat bed filter;
apparatus and method to filter contaminated liquid from a separate contaminant supply and deliver filtered liquid to a separate filtrate receiver consisting of

- a section of web of filter medium lying on and supported by a perforated support plate;
- cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of the said section of web of filter medium, thus forming an upper contaminant chamber;
- a receptacle for filtered liquid located beneath the support plate having upstanding rim portions, the upper surfaces of which make sealing engagement with the lower peripheral portions of the section of web of filter medium forming a lower filtrate chamber;
- means for engaging and disengaging the said upper and lower surfaces of the said upper cover and lower receptacle, thus sealing and releasing respectively the said portions of the filter web;
- a pressure pump located in a conduit in fluid connection with the means of the contaminant supply and the interior of the upper contaminant chamber;
- a suction/vacuum pump located directly or indirectly in or to a conduit in fluid communication with the interior of the lower filtrate chamber and a filtrate receiver;
- each of the said pumps alone providing the means to transport both contaminant and filtered liquid and thereby create a pressure difference between the contaminant and filtrate chamber;
- conduit means in fluid communication with a source of ~~compressed~~ gas ~~and/or the surrounding atmosphere~~ and the interior of the upper contaminant chamber;

- means for interrupting or initiating the flow of liquid or gas in the said conduits;
- means to control the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values;
- method for controlling the filtration operation whereby the said liquid level switches control the said means for interrupting and initiating fluid flow in the said gas conduits and said pressure switches are employed for interrupting or initiating the flow in the said liquid conduits;
- transport means in engagement with the filter web to transport it over the said perforated support plate;

w h e r e b y

Means additional to and independent of the said direct sealing engagement of the rim portions of the filter chambers and filter medium in the form of vertically moveable barriers of a resilient material in the sealing surfaces of the said rim portions of the filter chambers in the sealed position form a sealed/sealing space or spaces between or within the sealing surfaces into which fluid under pressure is present or introduced for which means can be provided for adjusting the pressure of the fluid introduced from an external source to the space or spaces.

2. Apparatus according to Claim 1 wherein the cover means takes the form of a horizontally positioned lid, the dependent rim of which engages the web of filter medium circumferentially, the said filter medium being positioned between the depending rim portion of the lid and the depending rim portion of the filtrate

AMENDMENTS Apps (May 2002)

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.
The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.
For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are [mainly] utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification [normally] involves [some form of] an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is [mostly] a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon [,etc., all normally] in powder form. The solid residues can [rarely] not be economically regenerated and their disposal poses an acute environmental problem.
On the other hand, using apparatus of the nutsche-type filter [in the form of] with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out [most of] the large variety of suspended solids contained in industrial liquid effluent.

[and]

- produce excessive amounts of contaminated back-wash liquid.

and

- [Added to this,] the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused [and the necessity for utilizing relatively coarse granular material comprising the beds for removing organic and inorganic contaminants in solution] thus [precludes] precluding [on economic grounds] the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing [relatively small concentrations of] specific [organic and inorganic] contaminants [in solution and in a colloidal state] in the field of effluent and water purification.

- [Prior art sand filtration inherently lacks the flexibility and versatility to handle today's demanding liquid purification requirements in the liquid processing industries.]

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated [and reused] more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation. [for disposal.]
Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes.
It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in medium to small size industrial sectors. This will be achieved by ulitizing specific throughputs 10-100 times those normally employed by prior art filters. Specific throughputs of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a [A] further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment. [The aim of the invention with] As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for [continuous total media] regeneration to avoid altogether the necessity for waste dumping into the environment.
THE INVENTION
Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

[Fig. 1 is a] The schematic flow-sheet of the apparatus of the invention Fig.1 [that consists of a] shows the purifying filter plant 1, comprising essentially a lower stationary filtrate chamber 2 with a porous upper surface on which a section of an

intermittently movable filter belt 4 is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions 3 of an upper contaminant container 5 fitted with a conically perforated feed distributor 27 extending over the entire upper horizontal section, a bed regeneration apparatus 6, a bed material storage/dosing [vessel] device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.

Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions of bed material recycled from regenerator 6 and activated powdered adsorbents are dosed using means 7/20 and 8/19 under pressure to a mixing section [27] 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 13 and 14 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process parameters (concentration) controlled include turbidity, pH, hardness, chlorinated [organics] organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as process variables such as pressure differential and throughput. Filtrate is recycled, if necessary, by means of a suction/[vacuum] pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter [(] by means of ultra-sonic [devices], turbulence and diffusion producing devices [diffusion enhancing processes,] [etc.] from the internal and external surfaces of the granular material, [which may be an adsorbent itself,] thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally [taking the form of] hydraulic or pneumatic rams, are provided for actuating the dependent rim

portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media 209, 210 are provided for feeding sections onto the lower filtrate chamber 2. Drive rollers 220, 221 located on the surface of the media rolls and actuated by a brake/clutch mechanism 225 driven by the filter belt 217 through idle rollers 207 feed lengths of filter band over a [guides] guide 223 into the rollers 207 onto the surface of the moving filter belt 217. Belt sensor 218 shuts down the belt drive motor 216 and actuates the band slitting mechanism 208 after which the [section] sections of filter medium and the supporting filter belt are finally positioned in the container 5 and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used [sections] section of filter medium [are] is [normally] transported out of the container 1 for disposal.

Cassettes 212, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles by means of actuated rubberized rollers 213 and fed on guides 224 to synchronously driven feeder belt or belts 214, whereby after positioning on the porous upper surface of the filtrate chamber 2, the dependent rim portions 3 of the container 5 are lowered to seal both the belt and the overlying section of filter medium. After the filtration operation the [material] section of filter medium is transported out of the container 1 for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims 3 [when they take the form of] as peripheral, integral sides of the container 5 are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders 215/304 is exerted when sealing the container 5 against the horizontal pervious base 2. The bodies of the cylinders 305 are fixed to an external load-bearing framework 306 with the external extremity of the lubricated shafts 307 connected to the lower ends of vertically sectioned cylindrical sleeves [302] 301 extending to and fixed at the [top end to] ends of transverse beams 308 [that] which in turn actuate thrust shafts 303 acting directly through seals onto the top peripheral part of the container 5. Annular sections of guiding plastic material [301] 302 [preferably out of polytetrafluorethylene,] are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves [302] 301.

Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:

A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent [information] data are entered into the programmed microprocessor 15 and the following sequence of operations proceeds fully automatically:

Start

Testing:

1. A section of 10 micron retention filter paper from 212 is automatically fed into the container.
2. The dependent rim portions of the container 5 are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller 404 establishes a pre-set pressure differential between the chamber sealing space 402 and the filtrate chamber 403.
4. With the container 1 vented, approx. 15 l/m^2 of the suspension are introduced to the top container 5 and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve 407, whereby the gas pressure and flow controllers 405/6 control the filtration operation and [provide the data input to the microprocessor for computing] indirectly establish the filtration characteristics of the suspension by [measuring] determining the [instantaneous] volumetric flow of gas in the top container 5. Simultaneously,[A sample of] filtrate flows through a turbidity meter 410 to record the degree of clarity of the filtrate for input to the microprocessor.

L .....

The computer chooses the filtration mode and type of medium.
Mode: pre-coat with medium speed diatomite with 1% body feed.
Medium: 20 micron polyester[-monofil] mono-filament section of belt.

.....

6. The [depending] dependent rim portions 3 are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container 1.
8. Steps 3,4,5 are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative. The section of belt is subjected to a standard cleaning/regeneration procedure after which steps 3,4,5 are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container 5.

Filtration Operation:

10. While the chamber 5 is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve 401. The feed rate is controlled by a pressure differential controller 405. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve 401 shuts.
12. Valve 407 opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller 406 signals a break-through of gas through the filter cake.

Cake Washing:

14. Valve 407 shuts.
15. Valve 408 opens. A pre-set quantity of wash liquid is fed to the container 5.
16. Valve 408 shuts. Valve 407 opens. Gas forces wash liquid through the cake.
17. The flow controller 406 signals a break-through of gas through the filter cake.

Cake Drying:

18. [Cake drying.] Gas continues to flow through the filter cake.
19. [Timer shuts valve]Valve 407 shuts. Container is vented by opening 411. Container opens.

Cake Discharge:

20. Belt transport. [Cake discharge.]
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container 1.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber 2, whereby the prior art fixed pervious bed [of the prior art] is replaced by manually removable pervious elements 502 to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members 504. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate 505 with smooth polished upper surfaces on which the removable elements, [preferably] consisting of expanded sheets or layers of woven mesh of metal or plastics [that] which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits 506 are provided, [preferably] coinciding with the [intevals] intervals of the fluid driven cylinders 215, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.

Fig. 7 shows a schematic drawing, wherein the filter web [takes the form] consists of a belt that is driven by a motor or actuator 702 to reverse the direction of transport of the belt to enable the discharge of the filter bed or filter cake at either end of the purifying apparatus 1. One of the major advantages of this configuration is that the permanent attachment of a bed regenerator 6 and a filter cake receiver at either end can be [achieved.] accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries. The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce [considerable] considerably the present negative impact on the environment.

Clean version

APPARATUS FOR LIQUID PURIFICATION

Description

This invention concerns apparatus for the purification of liquids. By purification is meant the removal of unwanted suspended, colloidal or dissolved substances from a liquid.

The prior art apparatus to achieve this consists of a large variety of generically related filters that utilize over-pressure and/or under-pressure to provide the necessary pressure difference for filtration.

For the purification of liquids, filter presses or pressure leaf, candle and cartridge filters (pressure vessels containing such elements) are utilized. Such liquids are chemicals, pharmaceutical products, beer, wine, sugar, oils and fats, petroleum products, etc. Their purification involves an "in-depth" filtration or purification process, whereby the liquid to be purified is either passed through or forms thereby a bed of particulate purification aid, whereby the separation mechanism is a combination of sieving-action and adsorption. The purification aids that are used include diatomaceous earth, bleaching earth, ion-exchange resin and activated carbon in powder form. The solid residues cannot be economically regenerated and their disposal poses an acute environmental problem.

On the other hand, using apparatus of the nutsche-type filter with open or closed containers, water is filtered by means of gravity or over-pressure on a large scale by means of thick, static beds of coarse granular material (e.g. sand). These beds are regenerated after filtration by back-washing techniques and reused. Although this method is suitable for the filtration of relatively clean surface and ground water, it is wholly unsatisfactory for the purification of industrial and domestic effluent. The reason is that the back-washing and regeneration techniques of prior art sand filters

- are inadequate for washing out the large variety of suspended solids contained in industrial liquid effluent.
- produce excessive amounts of contaminated back-wash liquid.

and

- the static nature of the beds is unsuited for the filtration of particulate matter as large sections of the bed remain unused thus precluding the possibility of utilizing the extensive range of available adsorbents comprising such materials as activated carbon, anthracite, ion-exchange resins, bleaching earth, molecular sieves, etc. required for removing specific contaminants in the field of effluent and water purification.

The goal of this invention is to further develop the art and science of "in-depth" filtration utilizing beds of loose material for the purification of liquids such as processed by the above named industries, whereby the beds for reuse are regenerated more effectively than with prior art methods, resulting in a considerable reduction in the quantity of liquid and solid waste generation.

Considering the present practice in both the industrial and communal sectors of discharging effluent to the natural environment that is incompletely purified, the further goal is to provide these sectors with an effluent and water purification apparatus that will enable liquid effluent to be recycled and polluted water to be rendered suitable for domestic and industrial purposes.

It is further proposed that the apparatus of the invention will be far more compact and versatile compared with the prior art in that it can be installed not only in large industrial and communal plants, but also in medium to small size industrial sectors.

industrial and communal plants, but also in medium to small size industrial sectors. This will be achieved by utilizing specific throughputs 10-100 times those normally employed by prior art filters. Specific throughputs of 50-200 $m^3/m^2.h$ will be possible because the beds will be maintained in the "open" condition throughout the filtration and/or purification cycles. Yet a further goal of the invention is to provide the liquid purification apparatus of the invention with the means for automatically selecting and applying varying types and grades of filter media and modes of operation according to the nature, filtration characteristics and requirements of any type of liquid purification operation, whereby no further distinction will be made between effluent, water and process liquid purification. The ultimate aim of the invention is to reduce the number of purification steps presently required for process liquid purification, whereby waste generation will be reduced and the purification media regenerated and reused, thus enhancing the competitiveness of these industries and simultaneously relieving the present negative impact on the environment: As for industries presently using liquids in their production processes for such operations as plating, dyeing, washing, coating, pickling, quenching, etc. the aim is to provide the means for regeneration to avoid altogether the necessity for waste dumping into the environment.

THE INVENTION

Fig. 1 is a schematic flow-sheet of the apparatus of the invention.
Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention.
Fig. 3 is a sectioned drawing illustrating an improved apparatus for controlling the vertical movement of the container.
Fig. 4 shows apparatus for the control of the liquid purification process and filter operation.
Fig. 5 illustrates an innovative filtrate chamber design.
Fig. 6 shows schematically the concept of the reversible belt transport of the invention.

The schematic flow-sheet of the apparatus of the invention Fig.1 shows the purifying filter plant 1, comprising essentially a lower stationary filtrate chamber 2 with a porous upper surface on which a section of an intermittently movable filter belt 4 is supported which in operation is stationary and sealed at the periphery by vertically movable dependent rim portions 3 of an upper contaminant container 5 fitted with a conically perforated feed distributor 27 extending over the entire upper horizontal section, a bed regeneration apparatus 6, a bed material storage/dosing device 7/20, a filter aid suspension tank 11, one or more adsorbent storage/dosing devices 8/19, a reservoir for liquid to be purified 10 and a residue filter 9.
Filter aid suspended in liquid in tank 11 is dosed into the vented container 5. While the pressure difference between the container 5 and the lower filtrate chamber 2 is raised, liquid to be purified in reservoir 10, which may be dosed with flocculating substances such as polyelectrolytes, is pumped using means 22 from reservoir 10 into container 5. Simultaneously, suspensions of bed material recycled from regenerator 6 and activated powdered adsorbents are dosed using means 7/20 and 8/19 under pressure to a mixing section 29 of the delivery conduit 12 controlled by microprocessor 15 from input data from instrumentation 13 and 14 in the delivery conduit 12 and the filtrate conduit 16 respectively. The liquid quality and process parameters (concentration) controlled include turbidity, pH, hardness, chlorinated organic substances, mineral oil, heavy metals, phosphates, nitrates, etc. as well as

process variables such as pressure differential and throughput. Filtrate is recycled, if necessary, by means of a suction/pressure pump 28, through conduits 16, 17 to reservoir 10 until the concentration of contaminants in the filtrate is reduced to a set level as measured at 13. Filtrate flow is then switched to conduit 18 whence it is collected in a reservoir not shown. On reaching a pre-set pressure differential across the bed or a pre-set upper level of contaminant concentration as measured by instrumentation 13, pump 22 and all dosing apparatus are shut down and external gas is fed through conduit 23 to container 5 whereby the residual liquid in the chamber and bed is removed, after which the dependent rim portions 3 of the container 5 are raised and the bed is transported by the filter belt 4 and discharged into the bed regenerator 6. The dependent rim portions 3 are lowered onto a fresh section of belt and the cycle described above is repeated. The regenerator 6, in effect, removes adsorbate and entrapped particulate matter by means of ultra-sonic, turbulence and diffusion producing devices from the internal and external surfaces of the granular material, thereby regenerating, cleaning and restoring the desired activities to these surfaces. Clean liquid is introduced to 6 through conduit 24 and by means of hydraulic classification action the adsorbate and particulate matter are removed through conduit 25 to filter 9 to recover a solid waste. Depending on its nature, the recovered fluid is recycled to 10 or reprocessed. Not shown are the means for introducing and removing the bed regenerating and reactivating fluids to and from bed regenerator 6.

Fig. 2 is a schematic representation of a partly sectioned elevation of the media feeding mechanisms of the invention. Prior art filters have the disadvantage that a replacement of the filter medium involves lengthy shut-down periods and often excessive manual manipulation. A further goal, therefore, of the present invention is to provide the means for automatically and quickly fitting a large variety of prefabricated materials (e.g. membranes, paper, carton, etc.) to fulfil the requirements of the liquid processing industries. Pressure cylinders 215, normally hydraulic or pneumatic rams, are provided for actuating the dependent rim portions of the filter container 5 in the vertical direction for bed removal and container closure and sealing.

A plurality of rolls of filter media 209, 210 are provided for feeding sections onto the lower filtrate chamber 2. Drive rollers 220, 221 located on the surface of the media rolls and actuated by a brake/clutch mechanism 225 driven by the filter belt 217 through idle rollers 207 feed lengths of filter band over a guide 223 into the rollers 207 onto the surface of the moving filter belt 217. Belt sensor 218 shuts down the belt drive motor 216 and actuates the band slitting mechanism 208 after which the sections of filter medium and the supporting filter belt are finally positioned in the container 5 and the depending rim portions of the container are lowered to seal the periphery of said sections. After filtration the used section of filter medium is transported out of the container 1 for disposal.

Cassettes 212, located externally to the filter container 1, are designed to feed pre-cut, pre-fabricated sheets of various types of filter media such as membranes, paper, carton, etc. into the filter container for filtration. Individual sheets are taken from the top of spring-loaded bundles by means of actuated rubberized rollers 213 and fed on guides 224 to synchronously driven feeder belt or belts 214, whereby after positioning on the porous upper surface of the filtrate chamber 2, the dependent rim portions 3 of the container 5 are lowered to seal both the belt and the overlying section of filter medium. After the filtration operation the section of filter medium is transported out of the container 1 for disposal.

Fig.3 is a sectioned drawing showing an improved method for ensuring that the dependent rims 3 as peripheral, integral sides of the container 5 are actuated in the horizontal orientation when raised and lowered and that the full thrust of the fluid driven pistons in the cylinders 215/304 is exerted when sealing the container 5 against the horizontal pervious base 2. The bodies of the cylinders 305 are fixed to an external load-bearing framework 306 with the external extremity of the lubricated shafts 307 connected to the lower ends of vertically sectioned cylindrical sleeves 301 extending to and fixed at the ends of transverse beams 308 which in turn actuate thrust shafts 303 acting directly through seals onto the top peripheral part of the container 5. Annular sections of guiding plastic material 302 are fixed to the surface of the cylinders fitting into spaces between the surface of the cylinders and the inner surface of the reciprocating sleeves 301.
Fig. 4 is a schematic representation of part of the apparatus of the invention for controlling the

- automatic selection of filter media;
- automatic selection of the optimal mode of filtration or purification;
- automatic measurement of the permeability of sections of filter media;
- automatic regeneration of partially "blinded" sections of filter media.

A typical procedure according to the invention for the filtration or purification of a quantity of liquid of unknown filtration characteristics is the following:
A liquid is to be clarified, whereby the filtrate in the filter residue (cake) is to be recovered by a washing operation. The required degree of clarification in units of turbidity is known. This and other pertinent data are entered into the programmed microprocessor 15 and the following sequence of operations proceeds fully automatically:
Start

Testing:

1. A section of 10 micron retention filter paper from 212 is automatically fed into the container.
2. The dependent rim portions of the container 5 are lowered to seal the section of paper lying on the filtrate chamber.
3. The differential pressure controller 404 establishes a pre-set pressure differential between the chamber sealing space 402 and the filtrate chamber 403.
4. With the container 1 vented, approx. 15 l/m^2 of the suspension are introduced to the top container 5 and distributed over the surface of the sealed section of filter paper.
5. Compressed gas is introduced to the top chamber through control valve 407, whereby the gas pressure and flow controllers 405/6 control the filtration operation and indirectly establish the filtration characteristics of the suspension by determining the volumetric flow of gas in the top container 5. Simultaneously, filtrate flows through a turbidity meter 410 to record the degree of clarity of the filtrate for input to the microprocessor.

.....

The computer chooses the filtration mode and type of medium:
Mode: pre-coat with medium speed diatomite with 1% body feed.
Medium: 20 micron polyester mono-filament section of belt.

.....

6. The dependent rim portions 3 are raised and the filter paper is discharged.
7. The 20 micron belt section is automatically positioned in the container 1.

8. Steps 3,4,5 are repeated with a liquid of known filtration characteristics.
9. (a) Result of permeability test: negative.
   The section of belt is subjected to a standard cleaning/regeneration procedure after which steps 3,4,5 are repeated.
   (b) Result: positive. With the container 1 vented, approx. 20 l/m^2 of diatomite suspension are introduced to the top container 5.
   Filtration Operation:
10. While the chamber 5 is being pressurised with gas, suspension to be filtered with 1% diatomite body-feed is introduced under pressure through valve 401. The feed rate is controlled by a pressure differential controller 405. Filtration proceeds.
11. On reaching a pre-set pressure differential, filtration terminates. Valve 401 shuts.
12. Valve 407 opens. Gas forces rest suspension through the filter cake.
13. Gas flow controller 406 signals a break-through of gas through the filter cake.
    Cake Washing:
14. Valve 407 shuts.
15. Valve 408 opens. A pre-set quantity of wash liquid is fed to the container 5.
16. Valve 408 shuts. Valve 407 opens. Gas forces wash liquid through the cake.
17. The flow controller 406 signals a break-through of gas through the filter cake.
    Cake Drying:
18. Gas continues to flow through the filter cake.
19. Valve 407 shuts. Container is vented by opening 411. Container opens.
    Cake Discharge:
20. Belt transport
21. Belt wash (belt wash liquid is used for subsequent cake wash operation).
22. 20 micron belt section relocated in the container 1.

-cycle repeated-

Fig. 5, 6 show a schematic representation of an innovative filtrate chamber 2, whereby the prior art fixed pervious bed is replaced by manually removable pervious elements 502 to facilitate the cleaning and/or sterilization of the internal surfaces and drainage members 504. According to the invention only planar, smooth surfaces of the floor of the filter chamber remain after the manual removal of the elements. In a preferred design, the filtrate chamber consists of hollowed-out plate 505 with smooth polished upper surfaces on which the removable elements, consisting of expanded sheets or layers of woven mesh of metal or plastics which are covered and are integral with flat perforated sheet, mesh or profiled grid material. To accommodate the high liquid through-puts of the invention and to minimize the bulk and cost of the elements, generously proportioned multiple filtrate outlet conduits 506 are provided, coinciding with the intervals of the fluid driven cylinders 215, whereby the conduits are made integral with the supporting framework and designed to support the filtrate chamber as well as to withstand the thrust of the closure of the upper container. These conduits are also designed for ease of access and cleaning.

Fig. 7 shows a schematic drawing, wherein the filter web consists of a belt that is driven by a motor or actuator 702 to reverse the direction of transport of the belt to enable the discharge of the filter bed or filter cake at either end of the purifying apparatus 1. One of the major advantages of this configuration is that the permanent

attachment of a bed regenerator 6 and a filter cake receiver at either end can be accommodated.

The above described invention effectively bridges the gap between prior art sand (in-depth) and pressure filters presently employed in the liquid processing industries.
The implications are that both liquid processing and using industries can be rationalized and improved to increase their competitiveness and simultaneously reduce considerably the present negative impact on the environment.

CLAIMS

1 . CANCELLED

2 . CANCELLED

3. "once amended"

[Liquid filtering apparatus according to Claim 1, thereby characterized, that means are provided to discharge the bed to a bed regeneration device (6), where the material of the bed is cleaned or cleaned and reactivated and thence recycled to a dosing device (7/20) and thence to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.] In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the

surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means (**6, 21**) for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an intermediate storage vessel for a subsequent filtration or purification cycle

4. "twice amended"
[Liquid filtering apparatus according to Claim 1, thereby characterized, that means are provided to discharge the bed to a bed regeneration device (6), where the material of the bed is cleaned or cleaned and reactivated and thence recycled to the dosing device (7/20) and thence dosed to the turbid liquid chamber (5) of the filtering apparatus (1) during the filtration operation, whereby the depth of the bed increases incrementally during the operation.]
A liquid purification system according to **Claim 3 "once amended"**, whereby means (7/20) are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.

5. CANCELLED

6. "twice amended"
[Liquid purifying apparatus and method according to Claim 5, thereby characterized, that a dosing apparatus (8/19) is employed to dose the active powdered material to the granular material of the bed either before or during the purification operation when the depth of the bed increases incrementally.]
A liquid purification apparatus according to **Claim 3 "once amended"**, whereby means (**7/20, 8/19**) are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.
7. CANCELLED
8. CANCELLED
9. "twice amended"
Liquid filtering apparatus according to [Claim 1, thereby characterized, that] [any one of Claims 1-6], **Claim 4 "twice amended" or Claim 6 "twice amended"** whereby means are provided in the form of a conically perforated distributor (**27**) that

extends over the entire internal cross-section of the turbid liquid chamber (5).

10. CANCELLED

11. CANCELLED

12. "twice amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, [Liquid filtering apparatus according to Claim 10,] whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut ["in-situ"] to appropriate length and then introduced to the interior of the turbid liquid chamber (5) [to coincide with the pervious horizontal

base (2)] and sealed at the periphery [(402)] by the dependent rim portion(s) (3) of the said chamber.

13. CANCELLED

14. "twice amended"

Liquid purifying apparatus according [to any one of Claims 4-6], **to Claim 4 "twice amended" or Claim 6 "twice amended"**[thereby characterized, that] whereby the dosing devices are controlled by a microprocessor (15) from input signals from feed and filtrate instrumentation (13,14).

15. "once amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in

engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, [Apparatus and method of filtration control according to the defining preamble of claim 10, whereby means to control the filtration operation consist of a gas flow controller, a gas throttling valve and a gas pressure controller connected in series from a source of compressed gas to the turbid liquid chamber (5), thereby characterized, that the said means are employed to measure the permeability of any filter media before or during any liquid filtration or purification operation by introducing and filtering a volume of liquid of known quality to the turbid liquid chamber] whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (406), gas throttling valve (407) and gas pressure meter (405) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

16. "once amended"

Method of liquid purification control according to Claim 12 or 15, [thereby characterized, that whereby the quality of the turbid liquid and filtrate is determined by instrumentation such as (13, 14), whereby optionally the data are fed to a microprocessor / process controller (15) to choose and implement the supply of the optional filter medium before or during any liquid purification operation.] whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (13, 14), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

17. CANCELLED

18. CANCELLED

19. CANCELLED

20. CANCELLED

uspswaterclaimsamend

Clean version 2 (May, 02)

CLAIMS

1. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for the surface of the belt itself to act as both the filter web and conveyor of a granular filter bed that after use as filter medium is conveyed to means **(6, 21)** for the cleaning, regeneration and return of the grains of the bed directly to the said upper contaminant chamber or to an intermediate storage vessel for a subsequent filtration or purification cycle.

2. A liquid purification system according to Claim 1, whereby means (7/20) are provided for dosing the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation.
3. A liquid purification apparatus according to Claim 1, whereby means (7/20, 8/19) are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.
4. Liquid filtering apparatus according to, Claim 2 or 3 whereby means are provided in the form of a conically perforated distributor (27) that extends over the entire internal cross-section of the turbid liquid chamber (5).
5. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage

means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber **(5)** and sealed at the periphery by the dependent rim portion(s) **(3)** of the said chamber.

6. Liquid purifying apparatus according to Claim 2 or 3 whereby the dosing devices are controlled by a microprocessor **(15)** from input signals from feed and filtrate instrumentation **(13,14)**.

7. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter **(406)**, gas throttling valve **(407)** and gas pressure meter **(405)** in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

8. Method of liquid purification control according to Claim 5 or 7, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means **(13, 14)**, single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

OA 8 / App. 6

Advisory Action

Application No.	Applicant(s)
09/242,072	Miller
Examiner	**Art Unit**
Ivars Cintins	1724

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED *Jun 7, 2002* FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE. Therefore, further action by the applicant is required to avoid the abandonment of this application. A proper reply to a final rejection under 37 CFR 1.113 may only be either: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

THE PERIOD FOR REPLY [check only a) or b)]

a) ☒ The period for reply expires *3* months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection. ONLY CHECK THIS BOX WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

1. ☐ A Notice of Appeal was filed on _____. Appellant's Brief must be filed within the period set forth in 37 CFR 1.192(a), or any extension thereof (37 CFR 1.191(d)), to avoid dismissal of the appeal.

2. ☒ The proposed amendment(s) will not be entered because:

(a) ☒ they raise new issues that would require further consideration and/or search (see NOTE below);

(b) ☒ they raise the issue of new matter (see NOTE below);

(c) ☒ they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

(d) ☐ they present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: *See the attached supplement.*

3. ☐ Applicant's reply has overcome the following rejection(s):

4. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

5. ☐ The a) ☐ affidavit, b) ☐ exhibit, or c) ☐ request for reconsideration has been considered but does NOT place the application in condition for allowance because:

6. ☐ The affidavit or exhibit will NOT be considered because it is not directed SOLELY to issues which were newly raised by the Examiner in the final rejection.

7. ☒ For purposes of Appeal, the proposed amendment(s) a) ☒ will not be entered or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: *None*

Claim(s) objected to: *8, 9, 14, and 17*

Claim(s) rejected: *1-7, 12, 15, and 16*

Claim(s) withdrawn from consideration: _____

8. ☐ The proposed drawing correction filed on _____ is a) ☐ approved or b) ☐ disapproved by the Examiner.

9. ☐ Note the attached Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____.

10. ☐ Other:

IVARS CINTINS
PRIMARY EXAMINER
ART UNIT 1724

SUPPLEMENT TO ADVISORY ACTION

The proposed amendment filed June 7, 2002 has not been entered for at least the following reasons:

In the Specification

(1) Applicant's attempt to add to the disclosure that pressure cylinders 215 provide container sealing in addition to closure (see page 4, line 2 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter.

(2) Applicant's attempt to change the disclosure that "A sample of filtrate flows through a turbidity meter 410" to "Simultaneously, filtrate flows through a turbidity meter 410" (page 5, line 18 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter.

(3) Applicant's attempt to change the disclosure that "Cake drying" occurs in step 18 to "Gas continues to flow through the filter cake" (page 6, line 1 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter.

In the Claims

(1) Applicant's attempt to present currently pending claim 1, in its entirety, as amended claim 3 is improper and confusing.

If Applicant desires to merely eliminate the limitations of claim 3, then claim 3 should be canceled, and claim 1 left unchanged.

(2) Similarly, Applicant's attempt to present currently pending claim 2 as amended claim 4 is improper and confusing. Furthermore, the bracketed portions of "twice amended" claim 4 do not appear in currently pending claim 4. Currently pending claim 4 recites "Liquid filtering apparatus according to Claim 2 or 3, whereby means are provided in the form of a conically perforated distributor **27** that extends over the entire internal cross-section of the turbid liquid chamber **5**." See the amendment filed November 20, 2001. Moreover, as in claim 4, the proposed deletions from claims 6, 9, 14 and 16 do not appear in the currently pending version of these claims (see the amendment filed November 20, 2001 for claims 6 and 9; and original claims 14 and 16). Applicant should note that the proposed amendment filed April 9, 2001 was <u>not</u> entered because it was considered "non-compliant" as explained in the Office letter dated October 2, 2001.

(3) As in "(1)" above, merely rewriting currently pending claims 5 and 7 as 12 and 15, respectively, is improper and confusing.

Applicant is advised that any future amendments to the specification should only present paragraph(s)/section(s) (marked-up and clean versions) which are being changed, not the entire specification.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to I. Cintins whose telephone number is (703) 308-3840. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM.

The fax phone numbers for this art unit are: (703) 872-9311 for "Official" faxes after Final Rejection; (703) 872-9310 for all other "Official" faxes; and (703) 872-9492 for "Draft" and other "Unofficial" faxes.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Ivars C. Cintins
Primary Examiner
Art Unit 1724

I. Cintins
June 23, 2002

APP. 6

Objections in the specification:

1) "Attempts to add to disclosure that pressure cylinders 215 provide container sealing in addition to closure (see P.4, line 2 of marked up copy) not supported by original disclosure and therefore raises the question of new matter."

Applicant's response:

See P2 original disclosure line 30:

"Is supported which in operation is stationary and **sealed** at the periphery by vertically moveable dependent rim portions 3"

And P4, lines 16-20:

"Fig. 3 is a sectioned drawing showing an improved method for ensuring that the dependent rims 3 when they take the form of peripheral, integral sides of the container 5 are actuated in the horizontal orientation when raised and lowered and that the full thrust of **the fluid driven pistons in cylinders 215 is exerted when sealing the chamber** against the horizontal pervious base 2."

2) "Applicant's attempt to change the disclosure that "A sample of filtrate flows through a turbidity meter 410" to "Simultaneously, filtrate flows through a turbidity meter 410" (Page 5, line 18 of the "marked-up" copy) does not appear to be supported by the original disclosure, and therefore raises the question of new matter."

Applicant's response:

Adding the word "simultaneously" can't be considered as new matter. This is backed up by Fig. 4 of the original disclosure where clearly the filtrate forced from the chamber 5 by compressed gas must simultaneously pass through 410 which is located in the filtrate conduit itself.

3) "Applicant's attempt to change the disclosure that "Cake drying" occurs in step 18 to "Gas continues to flow through the filter cake" (page 6, line 1 of the "marked up" copy does not appear to be supported by the original disclosure, and therefore raises the question of new matter."

Applicant's response:

Page 3, lines 14-15 of original disclosure:

"and external gas is fed through conduit 23 to container 5 whereby **the residual liquid in the chamber and bed is removed."**

The term "drying" is commonly used in filtration circles for the partial removal of liquid in filter cakes by passing gas through them. The word "drying" is mainly used loosely and for those not versed in the jargon of the technology it is often thought to mean "the drying action on matter by means ot the application of heat". To avoid misunderstanding it is preferable to describe exactly what is meant by "drying" in the present specification. No new matter is being added in doing so. On page 3, lines 14-15, by feeding gas into the chamber and through the cake, the only interpretation is that the residual liquid in the cake is removed

by pressure differential and/or by entrainment. Another way of concisely putting this is that "gas continues to flow through the filter cake".
Naturally, if this gas were blown through the cake long enough under appropriate humidity conditions the cake would eventually be "dried". But this is not what is meant in the present invention, where one of the main objectives is to put the filter back on stream with as little delay as possible.
I hope this clarifies the matter.

Objections in the Claims:

1) "Applicant's attempt to present currently pending claim 1, in its entirety, as amended Claim 3 is improper and confusing. If the applicant desires to merely eliminate the limitations of Claims 3, then Claim 3 should be cancelled and Claim 1 left unchanged."
Claim 3 is now cancelled and Claims 1 and 2 are left unchanged.

2) "Similarly, Applicant's attempt to present currently pending claim 2 as amended claim 4 is improper and confusing".
Pending Claim 2 (as of office action 3 March, 2001):
"Liquid filtering apparatus according to Claim 1, thereby characterised, that means are provided to discharge the bed to a bed regeneration device (6), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse."
Amended Claim 4 (as of office action 3 March, 2001):
"A liquid purification system according to Claim 3, "once amended", whereby means are provided for **dosing** the cleaned and regenerated grains to the said contaminant chamber or to the feed of liquid to be purified during the purification operation."
Applicant's response:
The substance of this claim differs significantly from pending Claim 2 (as of office action 3 March, 2001).
The concept of **dosing** the material of the bed during the purification process has far reaching innovative consequences compared with the traditional method of preforming a static bed.
Claim 4 in this form has been retained now dependent on Claim 2.

2. (continued):
"Furthermore, the bracketed portions of "twice amended" Claim 4 do (should?) not appear in currently pending Claim 4".
Applicant's response:

Correct. The bracketed portion of pending Claim 4 (as of office action 10 March, 2002 concerning marked up version of claims) could have been deleted but to prevent confusion (the applicant's) it was retained.
(See enclosed corrected marked-up and clean versions)

2. (continued):
"Currently pending Claim 4 recites "Liquid filtering apparatus according to Claim 2 or 3, whereby means are provided in the form of a conically perforated distributor 27 that extends over the entire internal cross-section of the turbid liquid chamber 5. See the amendment filed November 20, 2001."
Applicant's response:
Referred to here appears to be the filed "CLEAN" version of amendments (as of office action 10 March 2002).
There does not appear to be an objection pertaining to this "CLEAN" version.
This appears as Claim 9 "once amended" in the current marked up version

2. (continued):
"Moreover, as in claim 4, the proposed deletions for claims 6,9,14,16 do (should ?) not appear in the current pending versions of these claims (see amendment filed November 20, 2001 for claims 6,9: and original claims 14,16).
Applicant's response:
This has now been put right (see enclosed corrected marked-up and clean versions).

Final corrected marked-up version O/A June 23,02

Claims

1. "twice amended"

Liquid filtering apparatus in the form of an open or closed vessel containing deep, static beds of coarse granular material such as sand acting as filter medium supported on a porous floor that divides the vessel into an upper turbid liquid chamber with an inlet nozzle or connection and an upper outlet or connection for the removal of bed back-washing liquid and a lower filtrate chamber with a back-washing liquid inlet nozzle and a filtrate outlet nozzle, whereby an operation to remove suspended solids the turbid liquid is preferably passed from top to bottom through the bed after which, and before repeating the cycle, clean liquid such as filtrate is passed through the bed from bottom to top to remove the solids trapped in the bed which leave the container as a suspension through a top outlet nozzle or connection, [thereby characterized that] whereby the container (1) with an upper turbid liquid feed conduit (12) and a lower filtrate outlet conduit (16) is divided in the vicinity of the pervious horizontal base (2) in such a way that a dependent rim portion(s) (3) of the upper turbid liquid chamber (5) is movable to facilitate the discharge of the bed from the container.

2. "twice amended"

Liquid filtering apparatus according to Claim 1, [thereby characterized, that] whereby means are provided to discharge the bed to a bed regeneration device (8), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.

3 Cancelled

4. "twice amended"

A liquid purification system according to [Claim 1] Claim 2, whereby means are provided for dosing the cleaned and regenerated grains to the said [contaminant] turbid liquid chamber or to the feed of liquid to be purified during the purification operation.

5. Cancelled

6. "twice amended"

A liquid purification apparatus according to [Claim 1] Claim 4 "twice amended", whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

7. Cancelled

8. Cancelled

9. "once amended"

Liquid filtering apparatus according to [anyone of Claims 1-6] Claim 4 "twice amended" or Claim 6 "twice amended", whereby means are provided in the form of a conically perforated distributor (27) that extends over the entire internal cross-section of the turbid liquid chamber (5).

10. Cancelled

11. Cancelled

12. "once amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber (5) to coincide with the pervious horizontal base (2) and sealed at the periphery by the dependent rim portion(s) (3) of the said chamber.

13. Cancelled

14. "twice amended"

Liquid purifying apparatus according to [any one of Claims 4-6] Claim 4 "twice amended" or Claim 6 "twice amended", whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

15. "once amended"

In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

16. "twice amended"
Method of liquid purification control according to [Claim **12** or **15**] Claim 6 or 8, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

17. Cancelled

18. Cancelled

19. Cancelled

20. Cancelled

Claims

!. Liquid filtering apparatus in the form of an open or closed vessel containing deep, static beds of coarse granular material such as sand acting as filter medium supported on a porous floor that divides the vessel into an upper turbid liquid chamber with an inlet nozzle or connection and an upper outlet or connection for the removal of bed back-washing liquid and a lower filtrate chamber with a back-washing liquid inlet nozzle and a filtrate outlet nozzle, whereby an operation to remove suspended solids the turbid liquid is preferably passed from top to bottom through the bed after which, and before repeating the cycle, clean liquid such as filtrate is passed through the bed from bottom to top to remove the solids trapped in the bed which leave the container as a suspension through a top outlet nozzle or connection, whereby the container (1) with an upper turbid liquid feed conduit (12) and a lower filtrate outlet conduit (16) is divided in the vicinity of the pervious horizontal base (2) in such a way that a dependent rim portion(s) (3) of the upper turbid liquid chamber (5) is movable to facilitate the discharge of the bed from the container.

2. Liquid filtering apparatus according to Claim 1, whereby means are provided to discharge the bed to a bed regeneration device (6), where the bed material is cleaned or cleaned and reactivated and recycled to the turbid liquid chamber (5) of the filtering apparatus (1) for reuse.

3. A liquid purification system according to Claim 2, whereby means are provided for dosing the cleaned and regenerated grains to the said turbid liquid chamber or to the feed of liquid to be purified during the purification operation.

4. A liquid purification apparatus according to Claim 3, whereby means are provided to dose pre-mixed or separately dose cleaned and regenerated grains of the bed with the powdered adsorbent materials to the said contaminant filter chamber or the feed of liquid to be purified during the purification process.

5. Liquid filtering apparatus according to Claim 3 or Claim 4, whereby means are provided in the form of a conically perforated distributor (27) that extends over the entire internal cross-section of the turbid liquid chamber (5).

6. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of

said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby sections of the band are used as support for discrete strips of prefabricated filter media from storage means pre-cut to appropriate length and then introduced to the interior of the turbid liquid chamber (**5**) to coincide with the pervious horizontal base (**2**) and sealed at the periphery by the dependent rim portion(s) (**3**) of the said chamber.

7. Liquid purifying apparatus according to Claim 3 or Claim 4, whereby the dosing devices are controlled by a microprocessor (**15**) from input signals from feed and filtrate instrumentation (**13,14**).

8. In a travelling web, flat bed filter apparatus that functions intermittently and in the stationary, sealed position receives contaminated liquid in a horizontal upper chamber and delivers filtered liquid from a lower filtrate chamber having a section of filter web or medium lying on and supported by a horizontal, fixed, pervious support plate or fixed drainage plate; cover means with dependent rim sections extending downwards, the lower surfaces of which make direct sealing engagement with peripheral portions of

said section of filter medium or web, thus forming an upper contaminant chamber; a receptacle for filtered liquid located beneath the support plate having upstanding rim portions or a drainage plate with extended rim portions, whereby the upper surfaces of said rim portions make sealing engagement with the lower peripheral portions of the section of the filter medium or web, thus forming a lower filtrate chamber or drainage space; means for engaging and disengaging the said sealing surfaces of the upper cover and lower receptacle or recess, thus sealing and releasing respectively the said portions of the filter web; either a pressure pump located in a conduit in fluid connection with the means of contaminant supply and the interior of the upper contaminant chamber, combined with a liquid pressure pump the inlet of which is in liquid communication with the interior of the said receptacle for filtered liquid; or a suction/vacuum pump located directly in a conduit in fluid connection with the interior of the lower filtrate chamber or drainage space or indirectly through a filtrate receiver with a conduit in fluid communication with the interior of the lower filtrate chamber or drainage space; each of said pump configurations providing the means for transporting both contaminated and filtered liquid thereby creating and maintaining a pressure difference between the contaminant and filtrate chambers or drainage space; conduit means in fluid communication with a source of compressed gas and/or the surrounding atmosphere and the interior of the upper contaminant chamber; means for controlling the filtration operation consisting of liquid level and pressure switches connected to the filter chambers set to switch at maximum and/or minimum values, whereby said liquid level switches control the means for interrupting and initiating fluid flow in the gas conduits and the pressure switches are employed for interrupting or initiating the flow in the said liquid and gas conduits; transport means in engagement with the filter web to transport it over the said support plate consisting of a belt conveyor connected on both sides with chain and drive sprockets, whereby the improvement comprises means for determining and/or controlling the rate of filtration of a quantity of liquid contained in the contaminant chamber comprising a gas flow meter (**406**), gas throttling valve (**407**) and gas pressure meter (**405**) in the said conduit in fluid communication with a source of compressed gas and the interior of the upper contaminant chamber.

9. Method of liquid purification control according to Claim 6 or 8, whereby in conjunction with the determination of the quality of the turbid liquid and filtrate by the means (**13, 14**), single sheets of known filtration characteristics are employed for determining the filtration characteristics of turbid liquids of unknown filtration characteristics, whereby the sheets after these determinations are transported out of the filter chamber for deposition or whereby sections of the filter band of unknown filtration characteristics are transported onto the said pervious support plate or fixed drainage plate for determining the filtration characteristics with liquids of known filtration characteristics.

Abstract

The invention concerns a liquid purifying apparatus that bridges the gap between prior art sand filters as applied mainly in the field of water treatment and pressure filters such as leaf, candle and cartridge filters as well as filter presses for filtration and purification in the liquid processing industries. In contrast to prior art sand filters where static beds of granular material are regenerated by back-washing techniques, the granular beds of the present invention are transported out of the filter container by a moving filter belt into an external bed-regenerating device after which the regenerated and reactivated bed is reused by dosing to the filter chamber with the incoming fluid to be purified. It is proposed to simultaneously dose a variety of active powdered adsorbents, such as activated carbon, molecular sieves, etc., to the purifier influent to remove specific dissolved contaminants, whereby the surface charge and particle size of this material are designed to adhere to the surface of the particulate matter of the bed. The dosing of active adsorbents and the particulate matter of the bed is controlled by a programmed microprocessor receiving input process data from influent and effluent instrumentation. A further feature is the provision of apparatus for feeding prefabricated sections of filter media such as membranes, non-woven and woven materials into the filter container for application in fully automatic operation throughout the whole spectrum of industrial and communal liquid purification processes.

OA9/App-7

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SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT		ATTORNEY DOCKET NO.
09/242,072	01/14/2000	Peter Anthony Miller		

	EXAMINER	
	I. Cintins	
	ART UNIT	PAPER NUMBER
	1724	29

DATE MAILED:

Please find below a communication from the EXAMINER in charge of this application.

Commissioner of Patents

Applicant's reply was received in the Office on August 16, 2002, which is after the expiration of the period for reply set in the Final Rejection mailed on March 13, 2002. In that Final Rejection, Applicant was given three months from its mailing date (i.e. until June 13, 2002) in which to respond. In the Advisory Action dated June 25, 2002, Applicant was reminded that the period for reply expires 3 months from the mailing date of the final rejection (see line "a"). Accordingly, the response filed August 16, 2002 has not been considered; and this application will become abandoned unless Applicant obtains an extension of time.

An extension of the reply period may be obtained by filing a petition under 37 CFR 1.136(a). The petition must be accompanied by the appropriate fee as set forth in 37 CFR 1.17 (copy of current fee schedule attached). The date on which the reply, the petition, and the fee have been filed is the date of the reply and also the date for purposes of determining the period of extension and the corresponding amount of the fee due. The expiration of the time period is determined by the amount of the fee paid.

Applicant is advised that in no case can any extension carry the date for reply to an Office action beyond the maximum period of **SIX MONTHS** set by statute.

Applicant is further reminded (see the first paragraph of the Advisory Action dated June 25, 2002) that in order to avoid abandonment of this application one of the following proper replies must be submitted:

(1) a timely filed amendment which places the application in condition for allowance;

(2) a timely filed Notice of Appeal (with appeal fee); or

(3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to I. Cintins whose telephone number is (703) 308-3840. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM.

The fax phone numbers for this art unit are: (703) 872-9311 for "Official" faxes after Final Rejection; (703) 872-9310 for all other "Official" faxes; and (703) 872-9492 for "Draft" and other "Unofficial" faxes.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Ivars Cintins

Ivars C. Cintins
Primary Examiner
Art Unit 1724

I. Cintins
August 23, 2002

5 Sept. 2002

Peter Miller
See Str. 27
71229 Leonberg
Germany
Fax/phone: 0049 7152 902234

05 Sept 2002
Commissioner of Patents and
Trademarks
Washington DC 20231

PURSUANT to CFR § 1.181

Complaint + Petition **to the Commissioner**

Re: US Appl. No: 09/242,072

Int. Appl. No : PCT/AU96/00442

Int. Filing Date : 05 Aug 96

COMPLAINT:

My application is being handled by the allocated examiner in a manner not in accordance with the letter and spirit of codes designed to protect the interests of individual inventors.

I am petitioning for relief from the situation that this particular examiner has now injustifyably steered me into in a way that I will now attempt to elucidate.

Actions leading to present situation:

9 Oct 2000	IPC Application version amended to comply with USPTO formalities requirements.	
10 March 2001	Summary Office Action I	All claims 1 – 20 rejected or objected to on merit and matters of form.
2 Apr. 2001	Applicants response I	All objections responded to.

13 March 2002	Summary Office Action II FINAL	New grounds for rejection and objection of ALL claims based on formal matters and the allegation of the introduction of new material in the final USPTO version.
7 June 2002	Applicant's Response II	All formal matters attended to and allegations of new material in the USPTO version disproved.
Interim comment:	At this stage according to normal office practice, prosecution as to the merits of the claims should have been formally closed and the condition of allowance except for formal matters declared.	
23 June 02	Office Action (Advisory Action) III	Examiner raises NEW issues as grounds for the continued rejection or objection of ALL claims and the specification. The issues consisted of further formal matters and alleged NEW MATERIAL in the final USPTO version of the application.
Interim comment:	According to normal practice, at the very latest on 23 June 02 the **application** should have conformed with the **condition of allowance.** Raising further NEW grounds for rejection, all of which were available to the examiner at the time of the Summary Office Action II FINAL, cannot be justified.	
16 Aug 02	Applicants Response III	All new matters responded to

Conclusion:

1. It is farcical for an examiner to set a period for response by an applicant if the period for response has already expired **before** the mailing date 23 June 02 of the Office Action (Office advisory action III).
2. All the applicants responses I, II and III were accurate, complete and exhaustive. There is no record in any Office Action of any non-acceptance of the applicant's previous response.

3. **No new grounds for refusal** concerning the introduction of new material or formalities are made by the applicant in any of the responses I, II and III.

PETITION:

To treat applicants Response III, filed 16 Aug 02 as timely and as basis for determining a declaration of allowance.

Peter A. Miller
Inventor and Applicant

PS: As a precautionary measure funds are available in my Deposit acc. 501200 to cover fees for any extension of time that may be necessary to further process my response filed 16 Aug 02 (CFR § 1.136).

OA10 / App B

MK-31

Application No.	Applicant(s)
09/242,072	Miller
Examiner: Ivars Cintins	Art Unit: 1724

Advisory Action

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED *Aug 16, 2002* FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE. Therefore, further action by the applicant is required to avoid the abandonment of this application. A proper reply to a final rejection under 37 CFR 1.113 may only be either: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

THE PERIOD FOR REPLY [check only a) or b)]

a) ☒ The period for reply expires *6* months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection. ONLY CHECK THIS BOX WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

1. ☐ A Notice of Appeal was filed on _____. Appellant's Brief must be filed within the period set forth in 37 CFR 1.192(a), or any extension thereof (37 CFR 1.191(d)), to avoid dismissal of the appeal.

2. ☒ The proposed amendment(s) will not be entered because:

(a) ☒ they raise new issues that would require further consideration and/or search (see NOTE below);

(b) ☐ they raise the issue of new matter (see NOTE below);

(c) ☒ they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

(d) ☐ they present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: *See attached supplement.*

3. ☐ Applicant's reply has overcome the following rejection(s):

4. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

5. ☐ The a) ☐ affidavit, b) ☐ exhibit, or c) ☐ request for reconsideration has been considered but does NOT place the application in condition for allowance because:

6. ☐ The affidavit or exhibit will NOT be considered because it is not directed SOLELY to issues which were newly raised by the Examiner in the final rejection.

7. ☒ For purposes of Appeal, the proposed amendment(s) a) ☒ will not be entered or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: *None*

Claim(s) objected to: *8, 9, 14, and 17*

Claim(s) rejected: *1-7, 12, 15, and 16*

Claim(s) withdrawn from consideration: *None*

8. ☐ The proposed drawing correction filed on _____ is a) ☐ approved or b) ☐ disapproved by the Examiner.

9. ☐ Note the attached Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____.

10. ☐ Other:

Ivars Cintins

IVARS CINTINS
PRIMARY EXAMINER
ART UNIT 1724

SUPPLEMENT TO ADVISORY ACTION

The proposed amendment filed August 16, 2002 cannot be entered because the "marked-up" version of the claims does not correspond to the "clean" version of the claims, as required by 37 C.F.R. § 1.121(c). For example, the "marked-up" version of the claims indicates that claims 3, 5, 7 and 8 have been cancelled, but the "clean" version of the claims presents text for these claims. Also, the "marked-up" version of claim 6 begins "A liquid purification apparatus ..." while the "clean" version of this claim begins "In a travelling web." Accordingly, "marked-up" claim 6 clearly does not correspond to "clean" claim 6. Similarly, "marked-up" claims 4 and 9 do not appear to correspond to "clean" claims 4 and 9. Furthermore, Applicant has presented a "marked-up" version for claims 12 and 14-16, but has failed to provide a "clean" version of these claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to I. Cintins whose telephone number is (703) 308-3840. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. David Simmons, can be reached at (703) 308-1972.

The fax phone numbers for this art unit are: (703) 872-9311 for "Official" faxes after Final Rejection; (703) 872-9310 for all other "Official" faxes; and (703) 872-9492 for "Draft" and other "Unofficial" faxes.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Ivars Cintins

Ivars C. Cintins
Primary Examiner
Art Unit 1724

I. Cintins
December 5, 2002

App. B

Peter Miller
2, Heighley Cottage
Espley
Morpeth
Great Britain
NE61 3BY

11.3.2003

Commissioner of Patents and
Trademarks
Washington DC 20231

PLEASE NOTE above new address of Peter A Miller previously 71229 Leonberg, Germany for all future correspondence from USPTO.

Appl.No: 09/242072
Filing date: 14.1.2000
IPC Appl. PCT/AU96/00442
Examiner : Cintins

Applicant's Response to Office Action dated 5 December 2002

Examiner's main point:

"The proposed amendment filed August 16, 2002 cannot be entered because the "marked-up" version of the claims does not correspond to the "clean" version of the claims, as required by 37 CFR §1.121©"

Applicant's response:

In the applicant's 37 CFR version (revised as of July 1, 1998) under §1.121© is

"*Amendments in reexamination proceedings*

Any proposed amendment to the description and claims in patents involved in reexamination proceedings must be made in accordance with §1.530(d)."

This is obviously not appropriate for the present case.

However perhaps the examiner had **§1.121(a)** in mind, namely:
"Amendments in nonprovisional applications"
In this paragraph and all other paragraphs of §1.121 dealing exclusively with the manner of making amendments there is no reference to regulations concerning "CLEAN" versions of specifications.
However referring to *Office Action,* 2 October 2001 (see Annex A) reference is made to 37CFR 1.121 as amended on September 8, 2000 in the following objections:
"1. The amendment does not include a clean version of the replacement section(s) 37 CFR 1.121(b)(1)(ii)"
and
"3. The amendment does not include a clean version of the amended claim(s) 37 CFR 1.121(c) (1) (i)"

The applicant responded by forwarding clean versions, whereby the Claims were numbered 1-9 consecutively omitting all cancelled claims and their numbering in the marked-up version..

This was accepted by the Legal Instruments Examiner the author of the Notice of Non-Compliant Amendment (37 CFR 1.121).
The posting of this Notice apparently passed through the hands of the Examiner and would appear that the officer responsible for

mailing this Notice failed to include the copy of an information flyer (MPEP Bookmark Bulletin on "Simplified Amendment Practice") declared to be forwarded to the Applicant by the Legal Examiner presumably as a gesture of support (see bottom paragraph of Annex A).

A copy of this Bulletin as well as 37 CFR 1.114 (RCE) would be welcomed by the Applicant even at this late stage.

Conclusion

The Applicant is convinced that if the latest version of the Simplified Amendment Practice had been timely forwarded to him as declared, the subsequent objections concerning *trivial matters of form* in the Application would have been avoided.

Attachment: Annex A

P Miller, Applicant and Inventor

USpatentoffice 4ää

OA 12

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/646,012	01/04/2000	Peter Anthony Miller		9520

7590 01/13/2003

Peter Anthony Miller
See Str 27
Leonberg, D 71229
GERMANY

EXAMINER
CINTINS, IVARS C

ART UNIT	PAPER NUMBER
1724	

DATE MAILED: 01/13/2003

34

Please find below and/or attached an Office communication concerning this application or proceeding.

Notice of Abandonment

Application No.	Applicant(s)
09/242,072	Miller
Examiner	**Art Unit**
Ivars Cintins	1724

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

This application is abandoned in view of:

1. ☒ Applicant's failure to timely file a proper reply to the Office letter mailed on *Mar 13, 2002*.

   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply (including a total extension of time of ____ month(s)) which expired on _____.

   (b) ☒ A proposed reply was received on *Aug 16, 2002*, but it does not constitute a proper reply under 37 CFR 1.113(a) to the final rejection.

   (A proper reply under 37 CFR 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).

   (c) ☐ A reply was received on _____ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non-final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box 7 below).

   (d) ☐ No reply has been received.

2. ☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).

   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).

   (b) ☐ The submitted issue fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____. The publication fee, if required by 37 CFR 1.18(d) is $_____.

   (c) ☐ The issue fee and publication fee, if applicable, has not been received.

3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).

   (a) ☐ Proposed new formal drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.

   (b) ☐ No corrected drawings have been received.

4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.

5. ☐ The letter of express abandonment which is signed by an attorney or agent acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.

6. ☐ The decision by the Board of Patent Appeals and Interferences rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.

7. ☐ The reason(s) below:

Ivars Cintins

IVARS CINTINS
PRIMARY EXAMINER
ART UNIT 1724

Petitions to revive under 37 CFR 1.137(a) or (b), or requests to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.